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THANKS
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OPEN ACCESS

Commodore speeds up datasette software, the £45 synthesiser, a Zaxxon lookalike, the Titchies strike back and Rolf's new didgerydoo . . . Open Access is where it's at.

Commodore Slow To Speed Up Loading Times

Commodore has finally realised that its own CBM 64 cassette programs take longer to load than anyone else's CBM 64 tapes. This is because everyone else ignores the 64's usual method for reading in tapes and substitutes their own fast-loader.

Commodore has now announced that it will use Novaload for all its future cassette based software. Novaload is a sophisticated fast-loading system allowing music and animated text while the program is loading! Novaload also incorporates software-protection. Software houses using Novaload include Ocean and Llamasoft.

A Calculated Move Into The Music Market

Latest in a number of sophisticated music packages for the 64 is Paradox's MusiCalc. The basic package is a disk-based synthesiser and sequencer. Further modules can then be added. These include a score writer, which prints standard musical notation on a Commodore printer; a keyboard-customising program, adding an additional 63 preset scales to the standard 17; a score template, adding 32 scores to the standard 32 melodies; a now-standard MIDI interface, to allow the system to be connected to other synthesisers; and a rhythm template.

The basic package costs £45 on disk. The additional modules range in price from £15 to £45. MusiCalc will be reviewed in a later issue of *Y64*; in the meantime, sound out Paradox on 01-240 2448.

World Peace Force Creates Havoc

Once upon a time you could launch a new game by saying "hey, world — here's a new game." Now, it seems, it's absolutely essential to claim that your game offers graphics "never before possible on a home micro."

The latest game to make this claim is Dynavision's Havoc — a Zaxxon-like action game. From the screen shots supplied, though, the game does look impressive. The idea is to defend your Homeland against the Mad Mullah and his ancient cruise missiles. You, of course, are a member of the World Peace Force, your mission to find the Mad Mullah's launch site and blast the hell out of it. Seems that the emphasis is on force rather than peace ...

Fast, 3D and Zaxxon-like: Dynavision's Havoc

The 3D, continuous-scrolling game is apparently ten minutes' flying time from one end to the other. *Y64* will be reviewing the game shortly; in the meantime, you can contact Dynavision on 0582-595222.

Good Housekeeping, Shame About The Software

Not content with producing mediocre 'drill-and-practice' software for three to six year olds, *Good Housekeeping* is intending to produce a range of software aimed specifically at women. The software, produced under the Ebury label, covers such subjects as cooking, gardening, cooking and interior design. The Good Housekeeping name will help women to overcome their fear of computers, says Ebury. I think if I were a woman I'd feel somewhat insulted, but if you want to know more you can talk to Roger (sic) Barrett on 01-439 7144.

Not just a serial cable, but an RS232 interface too. The Access Computer Company has put the interface into the end of the cable. Communicate with Access on 061-477 6013.

Romik Cerealises New Computer Game

Remember those lovable little Weetabix men, battling it out against 'titchy' breakfast cereals in tv ads? The battle is now taking place on a CBM 64: the computer game of the advertisement is here! Romik Software's *Weetabix versus the Titchies* is part of a Weetabix promotional campaign, and can only be ordered by filling in the order form on the back of special Weetabix packs. The game will retail at £2.75 for members of the Weetabix Club (don't ask me — ask Romik on 0753-71535), and £3.75 to the rest of us.



This is chilling?

Neither Thrilling Nor Chilling But Cheap

Latest to bring out a two quid game is Mastertronic with *Chiller*. The game is based on Michael Jackson's *Thriller*, involving a man walking through a forest and collecting blue crosses (yawn). Thrilling it ain't, but £1.99 it is. Let managing director Martin Alper convince you that it's really "a quite exceptional program" on 01-402 3316.



BUZZWORDS

Has Gremlin gone loco?

Ever since Stephenson launched his Rocket before an amazed public, there's been a fascination for all kinds of trains, which is presumably why **Gremlin Graphics** have chosen to feature a locomotive in their new game. But any similarity with the Rocket ends here — although Gremlin's *Suicide Express* does involve launching rockets.

The aim of the game is to take control of an ill-fated, space-age express and drive it safely through a futuristic landscape to the end of the line, all the time watching out for the bomber planes whose job it is to make sure you don't succeed (shades of *Loco* here, methinks). However, you're not completely defenceless as the engine's armed with missiles; their use however, is severely limited because it'll only be possible to fire them in the direction the train is travelling. So to maintain a successful defence the player will have to keep a careful eye on the plan view of the track, which'll be displayed at the bottom of the screen, and then make the necessary strategic changes in direction in order to avoid being hit. And to make matters worse, only the bombs can be destroyed, not the planes that carry them, and there'll also be one or more hovercraft to distract your attention. Whew! If success is to be achieved, the player will have to become proficient very quickly, especially as it's intended to allow the novice only three lives; one disappearing each time the train's hit.

According to Gremlin spokesman, Kevin Norburn, Suicide Express will feature a fast scrolling landscape, with the background and foreground both scrolling at different speeds, and this will give a 3D feel to the display. In addition there'll be a perspective view, which'll show the train growing larger as it approaches, and decreasing in size as it moves away. How much music, and what kind hasn't been decided yet, but the program should be finished by the end of October, and in the shops soon after, priced £7.95.

Sinister asteroids from Merlin

The new programs are on the way from **Merlin Software**, the first a shoot-em-up clone of the popular arcade game Asteroids. For those unfamiliar with it, the story goes as follows. On the screen is an alien worker, and it's his (or her) job to nip around the screen collecting crystals which — when mixed in the appropriate quantities, spells and prevailing wind — make up some sort of superior, and virtually indestructible being known as a *Sinister* (that's the name of the game, by the way). So, to avoid the hassle of having to search for special bombs to destroy the thing, the player will have to shoot the workers before they complete their task. Arcade freaks should look out for Sinister towards the end of October, which will sell for £7.95.

Santa's race for time

Ever ready to cash in on anything and everything, Merlin are working on a special Christmas program called *Santa*. Aimed primarily at the young, Merlin hope it will still appeal to children of all ages. Quite simply, the object of the game will be to control Santa, and help him deliver all those presents. But, of course, there'll be all sorts of hazards to avoid like slipping on the snow or getting stuck down chimneys. Unfortunately, no one at Merlin is too sure what will be included yet as it's still in the planning stages. Whatever the final decision, though, the men at Merlin will have to be quick or they'll find themselves in the same position they were in with *Wimbledon*. Back in the summer Merlin were working their 64s to destruction in order to produce the tennis game so that its release would coincide with the famous fortnight. However, no amount of effort was enough to produce the goods on time, and it was finally released three weeks after the tournament had finished. Let's hope they have better luck with Santa, which is planned to be sold for £7.95, and will (probably) be in the shops by mid November (December at the latest) (Well, early January at the *very* latest . . .).

Rolf with his latest didgerydoo.

Commodore Puts Rolf In The Picture

Commodore has managed to separate Rolf Harris from his Stylophone long enough to get him to endorse its new graphic art package *Picture Builder*. The cassette-based program is aimed at younger children, allowing pictures to be constructed using predefined shapes — either the standard Commodore character set or 250 dedicated shapes. Either a joystick or keyboard is used to 'collect' shapes from the bottom of the screen and 'drop' them elsewhere. Each shape can be individually coloured from the palette of 17 hues available. Pictures can then be saved to tape or disk and incorporated into other programs. *Picture Builder* costs £9.99 and is available from dealers. Commodore is now in Corby on 0536-205252.

THE OTHER TALKIN' 64... Speech 64 is a £30 speech synthesiser from Currah Computer (SIC) Components.

The unit is similar to the company's Spectrum speech synthesiser, Microspeech, but Speech 64 has a built-in 8k ROM vocabulary. The advantage of the ROM is that you can type in a number of words exactly as they are written, while still having access to allophones. Thus you can enter something like SAY "YOUR SIXTEE FOR IS GOOD FOR U" and get something vaguely recognisable. There are two pitches available, allowing very crude intonation.

The cartridge plugs into the expansion socket at the back of the 64, with a DIN lead inserted into the audio socket. Sound is through the tv or monitor, and the unit can be made to voice keys as they are pressed. Currah expects software houses to produce games using Speech 64 by Christmas.



Virgin To Be Less Promiscuous This Autumn

Virgin, bandwagon jumper extraordinaire, has found that the 'shove-out-as-many-titles-as-possible-and-hope-that-some-of-them-sell' approach it uses in the record business doesn't work with software.

Virgin Games has restricted its autumn launch to just six titles — half of which are for the 64. *Falcon Patrol II* is a sequel to the original, *Sorcery* an enchanced version of the Spectrum game of the same name and there's something else dubiously named *Terrorist*.

Virgin has also reduced the prices of its entire back catalogue of games. "We've thrown out our duff titles," said commercial director Jeremy Cook, "and are putting the rest on sale at £2.99 each." But you'll have to be quick if you want to take advantage of the offer — it ends on 30th November. Virgin is on 01-727 8070.

Tymac's talkies

Freedom from Commodore printers . . .

. . . and graphics too.

Speakeasy

If Speech 64 is a little beyond your budget at present, Tymac offer five games that talk without any additional hardware. In *Flyer Fox* you are a fighter pilot escorting an airliner through international skies, your task to protect the aircraft from an enemy attacker. *Gandalf the Sorcerer*, *Pegasus* and *Trials of Peseus* are all old-time fantasy arcade games, and in *First Strike* you have to save the world from nuclear destruction (nothing too ambitious, I see...). Each is priced at £9.95 on tape, £14.95 on disk. Nobody answered when I tried to phone Tymac but you can try on 01-643 8899.

Not just any old 64, but the millionth CBM computer to be manufactured at Commodore's Corby factory. Commodore opened the factory 15 months ago and is now producing machines at the rate of one every five seconds — and CBM hopes to double this rate when production is up to full capacity!

Impex Provides Graphic Illustration Of Printerface Capabilities

If you don't like the look of the Commodore range of printers, Impex Software supplies two printer interfaces which will allow you to use any centronics printer with your 64.

The MW302 supports alphanumeric characters only, so is only suitable for wordprocessing and program listings which don't involve graphics characters, and takes its power from the 64. The MW350, though, allows you to do anything you could do with a Commodore printer — including print the full Commodore graphics character set — but requires an external power supply for some printers. It contains the necessary conversion software in ROM, so is compatible with all 64 software.

The MW302 costs £66.95, and the MW350 £89.95. Both are available from Impex on 01-900 0999.

Stop press: Downsway Electronics has also announced a Centronics printer interface with ROM-based software. Like Impex's MW350, it will support the full CBM graphics set and retail for £28.50. The launch date is not shown at the time of writing: ask Downsway on 03727-27222.


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And cwikey! i

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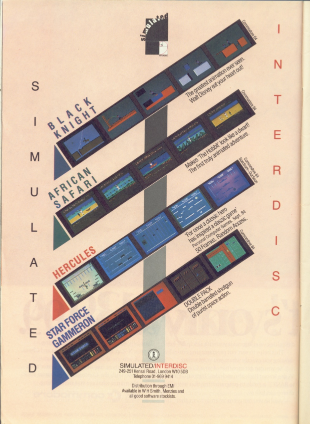
It uses BASIC (this is the language in which you and the computer "talk" to each other, right-ho!)

The BASIC used by the Commodore 16 is very advanced, yet really simple to use. This is because it gives you more programming commands.

But just in case any of you fellows do have any

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So you can get more out of your Commodore 16, the Starter Pack also includes "Introduction to BASIC," a guide to programming that any silly chump can follow.
And so you can get more enjoyment, there are four jolly good and splendidly challenging games: X-Zap, Punchy, Picture Builder and Chess.
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Micronet Launches Late Night Chat Show

Micronet users can now 'chat' to each other in (almost) real time. Micronet's Latenight Chatline enables users to send public messages onto a bulletin board; these messages can be read, and replied to by other users within a few minutes. Chatline, which is only open from 8pm until midnight each evening, is on Micronet page 811. Details of this and other Micronet services are available on 01-278 3143. *Y64* will be reviewing the CBM 64 Micronet database in a later issue.

CheetahSoft's remote-controlled games.

RAT Fodder

CheetahSoft's forthcoming games *Dragonfire*, *Moon Sweeper* and *Bear George* (*Bear* George? Ed.). All three will be compatible with Cheetah's RAT (*Enter the Rat*, issue 3, page 7) and are expected to retail for around £8. If the Spectrum versions are anything to go by, MoonSweeper is to be avoided at all costs — it's terrible! Bear George, though, is quite fun for younger children. CheetahSoft is on 01-833 4733.

PROJECT 64

Project is *Y64*'s regular reader project. Each Project will define a task and then invite your ideas on how it might be handled. We'll then build on your suggestions and comments every other month until we end up with a finished product. Some Projects will be directly useful while others will be merely interesting or fun. We will have two Projects running at any one time, on alternate months, to give you time to send in your contributions. All contributions should be sent to: *Y64 Project 2, 14 Rathbone Place, London W1P 1DE*. We regret that contributions cannot be returned, so please do *not* send an sae.

Project 2: Wordprocessor

Wordprocessing is arguably the most useful application for a micro. A wordprocessor of some description is all but essential for professional writers, highly desirable for amateurs and is useful even for people who write nothing more than the odd letter.

Commercial word-processing packages on the 64 range from simple text editors selling for less than a tenner to sophisticated packages costing fifty, seventy or even a hundred pounds. In this project, we're going to write our own *Y64* wordprocessor. We'd like you to tell us what sort of features you'd like it to include — particularly useful ones which nobody else appears to have thought of.

To start the ball rolling, here are a few random thoughts on the subject. Machine code is faster than Basic, obviously, but Basic is easier to type in and modify. A useful compromise may be to write the main program in Basic, but use machine code subroutines where speed is critical.

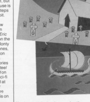
Because people have different equipment, we need to allow saving and loading to and from both tape and disk, and to allow printing in both 40- and 80- columns to suit the printer used.

What about features? Well, obviously we need to be able to enter text, edit, save, load and print! We may also want to be able to count the number of words in the file, allow 'paged' printing, support headers and footers and so on. And what sort of editing features do we want? Block delete? Copy and paste? Find and replace? Should the package be menu- or command-driven?

What we'd like at this stage are general comments and suggestions on the overall design of the program. In later issues we'll get down to detail.

Mosaic Ventures Into Science Fiction

It's taken a little while, but another software house is following in the footsteps of Melbourne's Hobbit. Mosaic has just announced three new adventures based on books. *The Saga of Eric the Viking* is based on the children's book by Monty Python star Terry Jones, *The Nomad of Time* on Michael Moorcock's Oswald Bastable stories and *The Stainless Steel Rat Saves the World* on the Harry Harrison sci-fi novel. All three retail at £9.95, and the latter includes a copy of the paperback. Mosaic is on 01-226 0828.



You've read the book, now play the game — Eric the Viking.

Lightning Strikes Twice

Too late for inclusion in last month's Basic Extensions feature comes Basic Lightning from Oasis Software. Offering over 200 extra keywords, Basic Lightning is a dedicated games-writing package. Oasis claims that the package is capable of multi-tasking up to five Basic subroutines, one in the foreground and four in the background. Also included is a Sprite Generator program and structured programming commands. The package will retail for £14.95 on tape, £24.95 on disk, and is expected to be ready by November.

If you want to produce fast-action machine code games, Oasis will sell you White Lightning instead — this does everything Basic Lightning does, but incorporates a compiler to produce stand-alone machine code games. White Lightning will cost £19.95 on tape, £29.95 on disk.

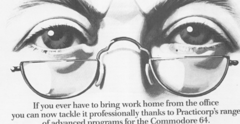
Ask Oasis why the disk versions cost a tenner more than the tape ones on 0934-419921.

A Moving Experience

Commodore Business Machines has now moved from Slough to its factory site in Corby. The new telephone number for information is 0536-205252.


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YC 4/11/84



OPEN ACCESS

PUZZLEPOINT 4

Mike Liardet challenges you to stretch your grey matter a little. The first three readers to solve the mystery of the missing multiples (and let us in on it) will each receive a £10 book token, so here goes ...

What have the numbers 41 652 789, 82 196 457, and 59 847 621 got in common? Well, they each lack the digit three and use the other digits one to nine once only. But multiply them by three and they then produce a nine-digit number using each of the digits one to nine:

3 * 41 652 789=124 958 367
3 * 82 196 457=246 589 371
3 * 59 847 621=179 542 863

Numbers with this property are fairly common; the first part of this month's task is to determine just how many such numbers there are. Unless you know something I don't, you'll have to write a program to solve the problem — or risk flat batteries on your calculator (and flat fingertips to boot). But here's a related problem that requires no programming for its solution: how many eight-digit numbers lacking the digit two and using the other digits one to nine once, produce a number with each of the digits one to nine, when multiplied by two?

£10 book tokens go to the first three readers to give the correct answers to both problems.

GROUNDRULES

1. Please write the solutions to both problems on the back of your envelope — just the two numbers.
2. All entries *on paper* please — no cassettes or disks.
3. All material will be retained by *Y64* and may be reprinted without further permission.
4. Entries must arrive by 30th November, and the judge's decision is final. No correspondence will be entered into.
5. Enclose a listing of the program used to calculate the solution to the first problem.

Send 'em in to: *Puzzlepoint, Y64, 14 Rathbone Place, London W1P 1DE.*

Writing For Y64

Y64 welcomes submissions of both programs and articles from readers.

In the case of programs, you should enclose the following items:
(a) Three verified copies (in case of LOADing difficulties) of the program on either tape or disk (disk preferred);
(b) A summary of what the program does and how it is used;
(c) Detailed instructions for use;
(d) A line-by-line breakdown (see *Keyboard Kapers* for an example of the sort of description we need).

Articles must be typed, computer-printed or clearly written. Write on one side of the paper only, leave wide margins all around and use double line spacing. If you use EasyScript, Paper Clip, Wordcraft 40 or Quick Brown Fox, please enclose a copy of the article on disk or tape as well as a printout; this is a great help to us. Both programs and articles should be accompanied by an appropriate sae so that your materials can be returned to you.

The more hi-tec of you can also send articles to us over the phone at either 300- or 1200-baud. Just phone Surya on 01-631 1433 to arrange this. You can also send short (<2k) messages to us via The Blandford Board (0258-54494) — leave a private message in the CBM 64 SIG addressed to *YOUR 64*. Longer messages and articles can also be sent via Telecom Gold addressed to 81:TCC007

All submissions must be the original, unpublished work of the author(s) and must not have been submitted elsewhere. You will normally hear from us within 4-6 weeks. The address for all submissions is: *Y64, 14 Rathbone Place, London W1P 1DE.*



You are commanding a squadron of four ground attack aircraft...

The mission is seemingly hopeless.

Fly along the river at zero altitude, twisting and turning crazily to stay within its tortuous banks, blasting at anything and everything in sight. Especially the bridges.

Three of your jets are held in reserve while you are pitched against Battleships, Enemy Aircraft, Land Tanks, Balloons, Helicopter Gunships. All intent only on your destruction.

And destroy you they will, if you don't get them first. You'll need to keep an eye on your fuel gauge. But take comfort, you can take fuel on board from one of the special depots.

If you get hit - and nobody has yet reached the end of the river - your next reserve starts at the last bridge you blasted on your way through!

Each target you destroy adds to your points score.

Like all Activision Software, River Raid will hold you and keep you coming back for more.

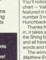
Chocks away!

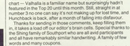
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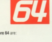
You'll notice a lot of familiar names cropping up again in our chart — Valhalla is a familiar name but surprisingly hadn't featured in the Top 20 until this month. Still, straight in at number 3 no one can say it's not making up for lost time, and Hunchback is back, after a month of falling into disfavour.

Thanks for sending in those comments, keep filling them in, it takes a load off our editor's brain cells. Special thanks to the Shing family of Southport who are all avid participants and all have remarkably similar handwriting. A family of few words and many coupons.

The winner of this month's surprise package of software is *Matthew Ember* of Wembley, Middlesex, and all for being the first to come out of the hat.

Help keep our chart up to date by filling in the coupon (that goes for you too, Shings) and getting it into the post in time for the next issue (it's sooner than you think!)

YOUR 64 CHOICE TWENTY



My top five games for the **Commodore 64** are:

1 ______________
2 ______________
3 ______________
4 ______________
5 ______________

Name ______________
Address ______________

All polling slips should be mailed to: **Your 64 Choice Twenty, 14 Rathbone Place, London W1P 1DE.** (By all means send a photocopy if you'd prefer not to harm the issue.)



YOUR 64'S TOP TWENTY

THIS MONTH	LAST MONTH	TITLE	COMMENT
1	9	**BEACH-HEAD** ACCESS	ABOUT TIME TOO! AT LEAST THE SHINGS GOT IT RIGHT —
2	4	**INTERNATIONAL FOOTBALL** COMMODORE	NUMBER TWO AND CLIMBING — KEEPS SOCCER FANS QUIET FOR HOURS — TONY WALTERS.
3	NEW	**VALHALLA** LEGEND	NOT ENOUGH BLOOD! — MG MERRINGTON
4	RE-ENTRY	**HUNCHBACK** OCEAN	QUASIMODO MUST HAVE BEEN ON HOLIDAY LAST MONTH BUT SLOUCHES BACK WITH A VENGEANCE.
5	6	**MANIC MINER** SOFTWARE PROJECTS	STRIKE ? WHAT STRIKE? WILLY HASN'T STOPPED ALL YEAR.
6	5	**FORBIDDEN FOREST** AUDIOGENIC	THE ARCHERS HIT THE SMALL SCREEN — MAT STILES
7	1	**REVENGE OF THE MUTANT CAMELS** LLAMASOFT	HAVE THE CAMELS QUENCHED THEIR THIRST FOR REVENGE OR ARE THEY JUST RESTING?
8	NEW	**TALES OF THE ARABIAN NIGHTS** INTERCEPTOR	THE ONLY GAME TO ACTUALLY TALK YOU INTO PLAYING IT — ANDREW CLARKE
9	13	**BUGABOO** QUICKSILVA	HELP A FLEA-BITTEN OLD DRAGON TO SURVIVE UNTIL THE NEXT ISSUE.
10	NEW	**DECATHLON** ACTIVISION	BIT LATE FOR THE OLYMPICS BUT BETTER LATE THAN NEVER — PAUL LYTTON
11	3	**THE HOBBIT** MELBOURNE HOUSE	SO BILBO CAN'T KEEP IT UP!
12	7	**AZTEC CHALLENGE** US GOLD	EXCELLENT SOUND AND GRAPHICS — SIMON CHARLES
13	NEW	**LOCO** ALLIGATA SOFTWARE	UNLUCKY FOR SOME — KEEP AN EYE ON THE SKY ON THE WAY HOME TONIGHT — T WHEELER
14	NEW	**DALEY THOMPSON'S DECATHLON** OCEAN	CAN DALEY MAKE IT TO NO. 10 BY NEXT MONTH?
15	NEW	**JAMMIN** TASKSET	NEVER HEARD OF IT BUT WORTH A TRY IF YOU SAY SO — ED.
16	NEW	**SHEEP IN SPACE** LLAMASOFT	YURI GAGARIN EAT YOUR HEART OUT — CHRISTOPHER COATES
17	NEW	**FLIGHT SIMULATOR II** SUB LOGIC	THERE'S A LOT OF NEW DENTS IN THE RUNWAY! — S MULCAHY
18	15	**SON OF BLAGGER** ALLIGATA SOFTWARE	BLAGGER THE KID HAS HAD HIS DAY
19	16	**CHINA MINER** INTERCEPTOR	BUT THESE ORIENTAL SCABS ARE NO MATCH FOR WILLY — JASON MACMILLAN
20	NEW	**ENCOUNTER** NOVAGEN	NOT ANOTHER 3D SHOOT-EM-UP! AT LEAST IT'S ONLY NO. 20

WHAT MAKES A GREAT GAME?

What makes the difference between a good game and a great one? If there's one question that every software house must constantly ask itself, that's it. What we'd like you to do is to tell us what *you* look for in a game. Simply put the list of features shown below into order of preference. For example, if you think that (a) Life-like graphics is the most important feature in a game, write down 1:a. If you think (b) Realistic sound effects is the next most important, write 2:b, and so on until you've completed the list of nine features. When you've done this, add another feature of your own using not more than 15 words. Then simply write the list, your own feature and your name and address on a postcard or the back of an envelope and send it to the address given below.

There are no less than 61 prizes to be won! The first prize is a copy of every program produced by US Gold during your lifetime! You'll get the complete range to date, and all future US Gold software will be forwarded to you as and when it becomes available. Also, since you're going to be too busy playing to hang around waiting for tapes to load, US Gold will not only supply all software on disk but throw in the disk drive too!

There are 10 second prizes of the complete range of US Gold software to date, and 50 runner-up prizes of a US Gold game.

US Gold is a British software house formed jointly by CentreSoft and Ocean Software. The company was set up to produce the best American software under licence in Britain. The current range of US Gold titles includes:

• Zaxxon • Beach-head • Bruce Lee • Forbidden Forest • Solo Flight • Aztec Challenge • Strip Poker • Slinky • Caverns of Khafka • Mystic Mansion

WIN £2000 WORTH OF U.S. GOLD PRIZES

(a) Life-like graphics
(b) Realistic sound effects
(c) Variety of screens
(d) Large playing area
(e) Ingenious plot
(f) Easy to learn
(g) Fast-action
(h) Requires thought
(i) User has lots of control over game
(j) Your own addition in a maximum of 15 words

Simply put (a) to (i) in order of preference (eg. 1:i 2:h 3:g 4:f 5:e 6:d 7:c 8:b 9:a) then add a feature of your own. Write your entry on a postcard or the back of an envelope together with your name and address and send to **US Gold Competition, Y64, 14, Rathbone Place, London W1P 1DE.**

The Rules

1. The decision of the judges is final. No correspondence will be entered into.
2. Entries which are illegible, incomplete or do not fully satisfy these rules will be disqualified.
3. All material sent will be retained and may be published without further permission.
4. All entries must be received by November 30th. Entries arriving after this date will not be considered.
5. All entries must be on a postcard or the back of an envelope.

MISSIVES

Y64 welcomes correspondence on any and all aspects of computing a la 64. Funnies, straights, anguished pleas for help. 14 Rathbone Place, London W1P 1DE.

Living History

£10 LETTER

What is going on here? I know computing has moved on a bit since the Nascom 1, but does that really mean that no-one knows the difference between a sensible machine and something that ought to be shredding vegetables?! I write as an old computing hand, long since banished to the arid lands of the mainframe, and but recently returned to the micro-oasis — guess what was the first modern machine I powered up, only the other day? Yes, a 64, with its hi-res graphics, its scintillating sound, its user-defined graphics, and its multi-colour sprites! Stone me! Poke this, peek that — What kind of sewing machine is this?

Well, I thought, it's obviously too difficult to fit all that sort of stuff into a BASIC ROM, mustn't grumble, eh? And then someone showed me a Spectrum — Beep, Draw, Move, Circle — so what if it's got a keyboard like a sponge pudding, at least you can program the thing without having to initialise the telephone directory! I'm going back to my Nascom.

Nellie Maynard (Mrs), Cowdenbeath, Scotland

What's a Nascom? Ed.

The Bear Facts

I read with interest the in-depth review of the Koala Pad in the October issue. As Audiogenic is the exclusive UK and Eire distributor for Koala products, I'd just like to take this opportunity to answer the minor criticisms raised by the reviewer.

Firstly, he makes the point that the Circle function generates an ellipse instead of the true circle. The reason for this is that, being an American product, the software was written to be compatible with the NTSC tv system, which has a different aspect ratio to PAL. At our request, Koala Technologies has written a European version of the software in which the Circle command gives you a much better class of circle. All future batches of the 64 Koala Pad will contain this new version.

Secondly, as he rightly says, the disk version does not save to tape. What he does not explain is why anyone should want to save to tape if they have a disk drive! However, the Koala Pad is now available with cassette software. This, of course, does allow you to save to tape, and also retains the disk option in case you upgrade to a disk drive.

Future batches of the Koala Pad will contain, free, a Print utility to allow you to print pictures to a dot matrix printer, and a Programmer's utility to allow you to use your pictures in your own programs, and use the pad as an input device for your own program. Could I warn your readers to beware of imports — only official Audiogenic Koala Pads will have these free utilities!

Finally, to set the record straight, the cartridge version of the 64 Koala Pad is no longer available. We will be selling only the disk and cassette versions, and the current price is £79.95 inc. VAT.

David Smithson, Audiogenic Product Manager

Upgrade Plea

Now that Commodore has finally brought out 3.5 Basic for the Plus 4 and Commodore 16 is there any chance that it will be making upgrade ROMs available for the Commodore 64 and VIC 20?

I bought a Commodore 64 several months ago and feel cheated that my machine does not have the sound and graphics commands available on the new machines.

It is surely not impossible. Dragon, Oric and Sinclair have all at one time or another made upgrade ROMs available so why not Commodore?

If Commodore does not give



MISSIVES

satisfaction, I believe that you as a Commodore users magazine should organise a petition to Commodore, to show the extent of feeling among their customers.
Arnold Scot
Cowley, Oxon
Commodore has no immediate plans for an upgrade. What do other readers think? Ed.

Name Of The Game

There seems to be some confusion about the relationship between Martech Games and Durell Software, with many magazines referring to us as Martech/Durell. Quite simply there is no relationship between these two completely independent companies, other than that their tapes have been distributed through Software Communications. As of November 14th 1984 Durell's contract with Software Communications ends, and buyers will be able to go direct to Durell.

We have also been asked why the company is called 'Durell' (NB: not spelt with two 'R's). The name might have come from Superman's father (Dur-el), and may well have been chosen in preference to some other, such as 'Wobble Soft'. Perhaps the best clue is that the managing director, Robert White, has the letter 'D' as his middle initial.
Robert J D White,
Durell Software
What does the 'J' stand for? Ed.

Ease Your Mind

In the beginning, I had a datasette. I had to invest in a 1541 disk drive to save my fingernails (I used to chew them while waiting for the datasette to load). Well the disk drive is fine and so are my fingernails now, it's my brain that feels chewed up instead. The problem is not the disk drive nor the Easyscript package that came free with it, it's the Easyscript manual. It's got me so confused I'm driven to ask your help. Is there anything anywhere that explains how to use the Easyscript in a way that the likes of me can understand?
Fiona Redbridge
Preston, Lancs.
I'm afraid it's the curse of the Commodore manual, but you'll be relieved to hear that help is at hand in the shape of *Working with Easy Script* by Randall McMullan, price £5.95. Ed.

Bored With Basic

I was given a 64 a couple of months back, and have already taught myself the rudiments of Basic, but I am getting fed up with the normal beginner-type exercises and I would like to start writing games of my own. I have a few ideas for games but they would take so long to write in Basic. I am writing to you to ask if you could give me any advice on a simpler and quicker method of programming?
Stuart Flynn
Uxbridge, Middlesex
You can start by taking a look at three packages designed specifically with budding games authors in mind: Scope by ISP (reviewed in *Basic Extensions*, issue 3, page 27), Basic Lightning by Oasis Software (see *Open Access*) or Games Creator by Mirrorsoft at £12.95. Details of the latter from Mirrorsoft on 01-822 3082. Ed.

Where It's At

I have a tip for CBM 64 users. I have just read your article about POKEing 214 and 211 to print characters at certain points of the screen, and I would like to share my method of converting programs which have been written for other computers which utilise the PRINT AT Y, X or VTABY:HTABX.

At the beginning of the program or during initialisation, type in this line:

```
LET CD$ = "(home) (25 cursor downs)"
```

Then every occurrence of a PRINT at or a VTAB:HTAB, type in:

```
PRINT LEFT$ (CD$,Y); TAB X
```

S.K.Y.
Bury, Lancs.

SWITCH TO OVERDRIVE

For all those suffering 1541 lethargy, Express claims to increase the execution speed of that infamous Commodore disk drive by some 200-300 per cent! Clive Embery puts this claim to the test.

The 1541 Express unit is cartridge software that aims to speed up the execution of disk commands on a standard 1541 disk drive. The distributor, Ram Electronics, claims that execution speed is increased by a factor of two or three, and although the actual increase depends on the application you're running, the claim does appear to be justified.

To fit the Express, you have to prise open your 64 and attach two jumper leads. The first clips onto the 6510 processor itself, the second onto the U14 chip. The Express cartridge then plugs into the cartridge port in the usual way. Essentially the U14 chip handles communication between the processor and the disk drive. The hardwire patch from the CPU to the U14 strongly suggests a rather interesting explanation of how the system works — but more on this later.

Fitting the Express is a two-minute job provided you follow the clear instructions in the manual. The second paragraph of the manual, incidentally, does point out that fitting the unit voids the guarantee; it advises those of a nervous disposition to consult their dealer!

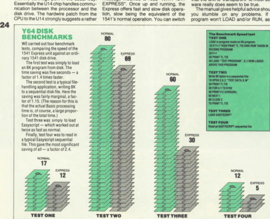
Picking-up Speed

Turning on the 64 with the cartridge plugged in — and fingers crossed, you should find the second line of the cold start message modified to read "WITH 1541 EXPRESS". Once up and running, the Express offers fast and slow disk operation, slow being the equivalent of the 1541's normal operation. You can switch between the two modes at any time using the CNTRL and function keys, but don't do it while the disk is running, as you'll almost certainly either lose or corrupt the data.

The border colour flashes black or dark blue in fast mode, and white or light blue in slow mode. In fast mode a number of useful changes are made; for example the default for all LOAD and SAVE commands becomes device 8 so you don't need to add a device number when using disk. SHIFTed RUN/STOP is the equivalent of LOAD"*",8 — LOAD and RUN the first program on the disk. If an error crops up during a disk operation, then it's automatically printed to the screen. The final bonus is that it allows access to the drive when you've got sprites on the screen... until testing the 1541 Express I hadn't realised this was normally impossible.

The unit reads and writes standard 1541 disks in either mode and makes no change whatsoever to the disk format. The only noticeable difference is the loss of one of the disk buffers — Express demands exclusive use of this in fast mode — but this is only a problem if you write or use software requiring the full complement. With the unit in fast mode I had no trouble running any of the software I tried (including Easyscript). However, as Express is a cartridge itself, this naturally excludes cartridge software. The claim that the unit is 'transparent' to most software really does seem to be true.

The manual gives helpful advice should you stumble on any problems. If a program won't LOAD and/or RUN, as a



Y64 DISK BENCHMARKS

WE carried out four benchmark tests, comparing the speed of the 1541 Express unit against an ordinary 1541 disk drive.

The first test was simply to load an 8K program from disk. The time saving was five seconds — a factor of 1.4 times faster.

The second test is a typical file-handling application, writing 8K to a sequential disk file. Here the saving was fairly marginal, a factor of 1.15. (The reason for this is that the actual Basic processing time is, of course, a large proportion of the total time.)

Test three was simply to load Easyscript — which worked out at twice as fast as normal.

Finally, test four was to read in a typical Easyscript sequential file. This gave the most significant saving of all — a factor of 2.4.

The Benchmark Speed test

TEST ONE

LOAD in program mode an 8K program:

```
10 IF F=1 THEN PRINT TI, TI$:END:REM TAKEN IN
SECOND PROGRAM
20 F=1
30 PRINT TI, TI$
40 LOAD "TEST PROGRAM", 8,1:REM LOADS
ABOVE THIS PROGRAM
```

TEST TWO

Write 8K bytes to a sequential file:

```
10 OPEN 2,8,2,"TEST DATA,S,W"
20 PRINT TI,TI$
30 FOR I=1 TO 8192
40 PRINT # 2,CHR$(65);
50 NEXT I
60 CLOSE 2
70 PRINT TI, TI$
```

TEST THREE

LOAD EASYSCRIPT

TEST FOUR

Read an EASYSCRIPT sequential file

SWITCH TO OVERDRIVE

last resort it suggests you pull out the Express (turning off your 64 first).

It seems the only limitation is that in fast mode you can only use one device on the serial bus. But if you've got a serial printer or another disk drive on the bus, you can still use the Express by jumping between fast and slow modes as and when necessary. (In direct mode you use the CNTRL and function keys; in program mode the software could prompt for the user to change the mode, or you can check the mode with a simple PEEK and set it as necessary with the appropriate POKE. 64 owners using a Centronics or RS232 printer or modem shouldn't need to adjust anything other than what the software itself dictates).

Running To Time

I carried out four speed tests, and although by no means exhaustive, they do give an idea of the time savings that can be made (see Listing 1). The timings are shown in Table 1. Express speeds up only the disk commands, not the execution of Basic statements; hence the modest improvements in tests 1 and 2. In machine code the limiting factor is often the speed of the disk drive — highlighted by test 2 where most of the time is taken up by the interpreter itself, whereas in test 4 the disk drive is the bottleneck and the unit comes through with flying colours. A straight LOAD or SAVE from Basic comes in about two times faster — which makes using the 1541 BACKUP program much less painful.

Quite how Express works is proprietary information, and although Ram Electronics wouldn't release details, it's possible to make an educated guess. Fast cassette systems usually bypass the 64's operating system altogether and substitute a more efficient one.

I suspect, however, that this is not true of 1541 Express, and for two reasons. Firstly, Express uses very little RAM — it's extremely unlikely that the company has fitted an entire new DOS into one of the disk buffers! Secondly, there is the connection between the CPU and the U14 chip. This strongly suggests that Express modifies the existing operating system — rather than replacing it with a new one.

If this is indeed the case, it would seem to pose an interesting copyright question. The Commodore DOS is, of course, the copyright of Commodore Business Machines. While the Express cartridge itself does not contain any part of this copyrighted material, it does appear to interrogate and modify the code in the 64's ROM.

Express Conclusions

The 1541 Express does not provide a significant increase in speed in a typical disk-based Basic program. The biggest bottleneck in a Basic program is the actual interpreting of the program — even in file-handling programs.

Where the unit does come into its own is in running disk-based machine code programs — particularly wordprocessors and databases.

There are, of course, a number of approaches to the problem of speed. Some 'turbo'-type cassette operating systems can equal or even improve on the speed of an unmodified 1541. Given that the 1541 is a serial device rather than a genuine parallel disk drive, for many applications a fast cassette operating system may be the cheap but effective answer.

But for business and/or serious use, a disk drive is vital. If you want a true parallel disk drive, you can always use one of the other Commodore units (the 2030, 3040 or 4040), but you'll need to buy an IEEE interface and the drives themselves are not cheap... it's an expensive option.

The Express doesn't work with all 64 software, (some packages require the whole disk buffer) but it does appear to work with most. I'd recommend you try it out with the software you intend to use before buying.

Overall, I was impressed by the time savings: if speed is important to you, I think you'll find that the 1541 Express is money well spent.

The 1541 Express cartridge is available from a limited number of dealers at £49.95, or direct from Ram Electronics (Fleet) Ltd, 106 Fleet road, Fleet, Hants, GU13 8PA adding £1 for P&P.

L.A.N.G.U.A.G.E LAB

Over the next few issues, the Y64 Language Lab will be presenting comprehensive reports on Pilot, Forth, Comal and Pascal — all of which will be examined via versions available on the Commodore 64. Dave Janda opens his account with a comparative overview of all four.

The language in which most hobbyists learn to program is, of course, Basic, and in many ways it's ideal for the purpose; it was designed in order to teach the concept of programming, and it's an all-purpose language. With only ten or fifteen hours' experience, it's possible to begin writing genuinely useful software.

But like any other general-purpose tool, Basic is not particularly well-suited to any one specific task. The price of adaptability is the loss of powerful and convenient features for specific applications. For this reason, it can be a very worthwhile investment to learn a second language. On the 64, you have a choice of five: Logo (see issue 2), Pilot, Comal, Forth and Pascal

This issue I'll be presenting just a brief summary of the last four. And to give an idea of what the syntax of each looks like, I've written their equivalent to a simple Basic program (see Chart). Over the months to come, I'll be covering them in detail — and examining them too from the point of view of a package specific to the 64.

PILOT

Designed for education

Pilot is the first programming language that Commodore itself has produced for the 64. It's supplied on disk only, and apparently the company has no intention at present of bringing out a cassette version.

Pilot is a computer assisted instructional (CAI) language, designed to enable teachers to produce educational programs quickly and easily. The primary idea behind Pilot is that it should be easy for teachers to produce programs that interact with the student on a question and answer level.

The version supplied is a superset of common Pilot, offering a number of extra facilities to allow use of the 64's colour, graphics and sprite capabilities. One such facility, text windows, enables questions and answers to be displayed on different sections of the screen. And graphics is adequately catered for with commands to draw and plot lines and to fill areas with colour. A group of sprite and colour commands is also included, the extensions allowing use of some of the 64's more advanced features.

The syntax of Pilot is simple enough, but you'll find instructions consist of a number of parts. First there'll be a one-letter opcode (there're 20 in all) and that will be optionally followed by a modifier which changes the way the opcode is executed. Conditions can then follow which will determine whether the instruction is to be carried out. Take this example:

```
TS(A=5): Correct, the answer is 5
```

Here the opcode T means print something, but the screen is first cleared with the modifier S. The condition is that the answer A equals five, and if so, the text in the field (everything following the colon) will be printed.

Look now at our Chart for the Pilot version of our standard Basic program. You'll see the demo program is the equivalent of the Basic program listed with it. The syntax is quite different (and not overly helpful) but once mastered, it's easy enough to use. In fact, Pilot is particularly suited to programs consisting of a series of inputs followed by the conditional outputs.

It'll be interesting to see how Pilot will be received in this country, since it has BBC Basic to contend with in the educational field. There's no great abundance of information on Pilot and its users — in fact to the best of my knowledge, there's no Pilot user group in this country. But I can give the address of one of the American user groups: Mr Larry Kheriaty, c/o Pilot User's Group, Computer Center, Room 334, Western Washington University, Bellingham, WA 98225, USA.

COMAL

A structured Basic

Comal is perhaps the easiest language for Basic programmers to get to grips with, since it's really nothing more than a structured Basic. The Comal version of our demonstration program (see Chart) is virtually identical to the Basic listing.

Comal was written by a Dutch programmer, and it's since become very popular in Holland, replacing Basic as the standard educational language in schools and colleges. Comal was also accepted by many educationalists in this country, and early versions appeared on Commodore PETs. Although the language has never exactly challenged Basic over here, Comal does appear to be making something of a come-back at present. A lot of the credit for that must go to the Independent Commodore Products User Group (ICPUG) — and especially Brian Grainger who edits 'Comal Corner' in the group's magazine.

The similarities between Basic and Comal make the latter an ideal introduction to other structured languages like Pascal. Unlike Pascal, however, Comal doesn't insist on modular programming. Although GOTO is not allowed, labels can be used to jump to a specified section of the program; even so, it does encourage a structured approach. Procedures are fully supported via the EXEC statement. Specifying EXEC parameters allows local variables to be assigned to procedures, and true multi-line functions may be created. A case statement is also incorporated, acting as a kind of flexible ON-GOSUB statement. LIST automatically produces an indented listing for ease of reading and Comal is more pleasant to program in since it 'fills in' bits that the beginner (or lazy expert) may leave out. Consider the following:

```
10 FOR A=1 TO 1000
20 B=A
30 NEXT A
```

This will be listed in Comal as:

```
0010 FOR A:=1 TO 1000 DO
0020 B:=A
0030 ENDFOR A
```

By the time you read this, Comal should be available from Commodore in cartridge form. Alternatively, ICPUG members can obtain the disk version from the user group.

FORTH

High level control language

Forth has to be one of the most popular programming languages available today, and it's now accepted by many manufacturers as the obvious second language for their machines. (A more cynical person than I might suggest that this is because it's public domain software — anybody

THE 64 LANGUAGE CHART

To give you an idea of what the syntax of each language looks like, here's a simple program to compare two numbers written in each of the four languages (plus a Basic version to act as a reference point).

```
10 PRINT "CLS"
20 PRINT "ENTER TWO NUMBERS"
30 INPUT "FIRST ";A
40 INPUT "SECOND ";B
50 IF A>B THEN PRINT A;"IS GREATER THAN";B
60 IF A<B THEN PRINT A;"IS LESS THAN";B
70 IF A=B THEN PRINT "BOTH";A;"AND";B;"ARE EQUAL"
```

PILOT

APPLICATION: Computer assisted learning
FORMAT: Disk only
SUPPLIER: Commodore
PRICE: TBA

```
ts:ENTER TWO NUMBERS
th:FIRST
a:#a
th:SECOND
a:#b
t(a>b):#a  IS GREATER THAN #b
t(a<b):#a  IS SMALLER THAN #b
t(a=b):BOTH #a  AND #b  ARE EQUAL
a:
```

COMAL

APPLICATION: General purpose language
FORMAT: Cartridge
SUPPLIER: Commodore
PRICE: TBA

```
0010 print "CLS"
0020 print "ENTER TWO NUMBERS"
0030 print "FIRST ";
0040 input a
0050 print "SECOND ";
0060 input b
0070 if a>b then print a;"IS GREATER THAN";b
0080 if a<b then print a;"IS SMALLER THAN";b
0090 if a=b then print "BOTH";a;"AND";b;"ARE EQUAL"
```

FORTH

APPLICATION: Control/machine application language
FORMAT: Cartridge
SUPPLIER: Audiogenic
PRICE: £29.95

```
: EQ A @ B @ = IF A @ A ? ." IS EQUAL TO " B @ B ? THEN ;
: GT A @ B @ > IF A @ A ? ." IS GREATER THAN " B @ B ? THEN ;
: LT A @ B @ < IF A @ A ? ." IS LESS THAN " B @ B ? THEN ;
: COMPARE EQ GT LT ;
```

PASCAL

APPLICATION: Educational/scientific
FORMAT: Disk and cut down cassette version
SUPPLIER: Oxford Computer Software
PRICE: £42 (Disk version)

```
PROGRAM TEST;
VAR
 A,B:REAL;
BEGIN
 PAGE;
 WRITELN('ENTER TWO NUMBERS');
 WRITE('FIRST ');
 READLN(A);
 WRITE('SECOND ');
 READLN(B);
 IF A>B THEN WRITELN(A,' IS GREATER THAN ',B);
 IF A<B THEN WRITELN(A,' IS SMALLER THAN ',B);
 IF A=B THEN WRITELN('BOTH ',A,' AND ',B,' ARE EQUAL');
END.
```

can implement it on any machine, without payment of a licensing fee.)

Forth was invented by Charles Moore in the late 60s and early 70s as a device-control language. It's best known for the purpose for which it was evolved — to control radio-telescopes (it's used for this purpose at Jodrell Bank). Because it was designed entirely by one man, there are only two standard versions: Fig-Forth and Forth 79.

Forth is often described as the high level/low level language; it has high level control constructs, and yet it operates very close to machine level — to the extent that you have to 'manually' manipulate a stack when using the language. The fact that Forth commands ('words') don't directly relate to what happens is at first a little confusing. The Forth word '.', for example, will print the number that's on

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communicate with far friendlie



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Signature

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*A new-style B.T. socket is required.
†Prestel and Micronet require additional subscriber charges.

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L.A.N.G.U.A.G.E LAB

the top of the stack; that's not something you're likely to guess from looking at the symbol!

Forth is, however, very powerful and in fact is almost as fast as machine code (another reason for its popularity). But perhaps its biggest asset is that the programmer is not tied down to a limited set of commands.

Forth procedures are held in a set of word definitions called (for obvious reasons) a 'dictionary'. This set of definitions can be added to by the user. For example:

: GREETING . "Hello";

defines a new word called GREETING which is added to the dictionary; whenever I need to print 'hello', I simply enter GREETING. User-defined words can be used within other Forth words, so if I wanted to define a word to print 'hello' a hundred times, the following would do it:

: WELCOME 100 0 DO GREETING LOOP;

Note that the new definitions are normally written using an editor, saved to tape or disk, and loaded with the Forth at the start of each session.

Over now to our demo program, and providing the variables A and B have been previously defined, the following (see Chart) will do. Note that the three words EQ, GT and LT have been combined into one word COMPARE, and only COMPARE need be used in future. Forth can be viewed as a 100 per cent procedural language in that everything is done using either built-in or user-defined procedures (words).

PASCAL

Enforced structure

There are certain things in life that you either love or hate, and Pascal seems to be one of them. You'll hear people telling you that Pascal is *the* language . . . or that they wouldn't touch it with a light-pen, both with equal ferocity.

Like Basic, Pascal was written simply as a language with which to teach the principles of programming, and only later did it grow into a commercial programming language in its own right. Pascal is suited to a wide range of tasks and although it's a high level language, it's also used to write applications software (the Lisa operating system, for instance, was written in Pascal).

Pascal was recently adopted in America as the official school programming language, and examinations which were previously based on Basic have now been changed to encompass Pascal instead. Its main feature — which can be seen as either an advantage or a disadvantage, depending on your point of view — is that it virtually forces you to write in a structured fashion. While this certainly makes 'quick-and-dirty' ten-liners difficult if not impossible, at least the finished product will be easy to follow and debug.

Unlike Basic, which supports only a limited number of pre-defined data-types — often just strings and numbers — Pascal allows the user to create his/her own data-types — chess pieces, or symmetrical shapes, for example.

At first sight, the structure of a Pascal program may appear strange to Basic users. The language requires groups of commands to be embedded inside blocks within the Pascal statements BEGIN and END. Procedures and functions are fully supported and can reference each other freely.

Look at the Chart for the Pascal version of our demo program. Note that PAGE is not standard — it clears the screen in the Oxford Computer Software Pascal. Also, notice that all the main statements are embedded within one BEGIN . . . END block.

Pascal requires all identifiers (variables) to be declared at the beginning of the program — as well as the arrays, contents, data-types and records. To the Basic hacker, this is horrible since it means you actually have to know what identifiers you are going to use before the program is written!

The language is difficult to get used to if you've come to it from something as chaotic as Commodore Basic, but once the disciplines have been accepted, your programs will be all the better for it.

Next month: a detailed look at PILOT

DELUSIONS OF ACOS

The convenience of a disk drive for the price of a cassette — that's how Melbourne House brazenly describes its Advanced Cassette Operating System (ACOS) for the 64. Priced at a mere £7.95, Ken T. Clark wonders whether the claim is too good to be true.

ACOS+ is a software package designed to enable the standard Commodore 'datasette' to suffer the delusion that it's been transformed into a disk drive. The idea is to provide reasonably fast loading and saving, a tape directory and pseudo 'random access' storage of complete files.

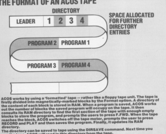
It comes supplied in the now traditional Melbourne House packaging — a 40-page instruction booklet and a tape that contains the ACOS loader program, a format program and a demonstration program called *Zorn*.

ACOS takes several minutes to load — an immediate drawback, since you have to go through the whole palaver every time you switch on. A cartridge would have been much more convenient, but of course would have trashed the exceedingly cheap price.

Before a tape can be used by ACOS, it has to be formatted using the Format program. This is loaded in from the ACOS tape — quite an involved performance, requiring plenty of button-pushing on the part of the user and an equal amount of number crunching on the part of the 64. As all tape recorders run at slightly different speeds, the first step for formatting is to synchronise your datasettes. You do this by timing a 3-minute length of tape; any deviation from that time will be noted by ACOS and taken into account when accessing the tape in future. The deviation is written to the tape directory, so the process need only be carried out once per tape.

The length of the currently-loaded tape is either entered or calculated (again, by timing a 'fast forward' through the tape). This is also stored in the tape's directory — then the directory itself is saved to the beginning of the tape.

THE FORMAT OF AN ACOS TAPE



ACOS works by using a 'formatted' tape — rather like a floppy tape unit. The tape is firstly divided into magnetically-marked blocks by the Format option. A directory of the content of each block is stored in RAM. When a program is saved, ACOS works out the number of blocks the saved program will occupy on the tape. It then consults its RAM directory to find the first section of the tape with enough empty blocks to store the program, and prompts the users to press F.FWD. When the tape reaches the block, ACOS switches off the tape motor, prompts the user to press RECORD and PLAY and then saves the program. Finally, it updates its RAM directory.
The directory can be saved to tape using the DIRSAVE command. Next time you use the tape, ACOS will read in this directory from the tape.
ACOS knows when to switch off the tape motor by timing the length of a F.FWD and comparing this time with the speed the tape is travelling. Because the start of the tape is required as a reference point, it is necessary to rewind the tape between operations.

Data and programs are stored after the directory in blocks of 512K. As each block consumes ten seconds of tape, an average 20K program would require 40 blocks and take the usual seven minutes to load and save. Timing is vital to the operation of ACOS since this is how it finds the location of a specific program.

Programs are saved using CSAVE; once the command has been issued, there are three steps involved to save a program:

1. You are prompted to rewind the tape and press RETURN. This supplies ACOS with a common starting point for all its timings (it may be tedious, but it works). ACOS calculates the size of the program, and searches its directory for the next free space on the tape large enough to hold the program.
2. Press 'Fast Forward' and ACOS stops the tape at the right place.
3. Press Play and Record, and the program is saved.

During this process the directory is updated in memory, but not written to tape; it should therefore be saved to tape using the DIRSAVE command. The DIRSAVE command doesn't prompt you to rewind the tape, so it's good practice to rewind after every operation.

To delete a program from the tape, simply delete its directory entry using DRUB; ACOS will then happily overwrite the program. Again, you must resave the directory as DRUB only alters the directory stored in RAM — any changes are lost when the 64 is switched off. ACOS also allows you to save areas of memory using the commands MSAVE and MLOAD, and data files opened with the COPEN command.

The full title of the Advanced Cassette Operating Sytem is ACOS+. The plus in the title refers to a free bonus which comes as part of the package — an extra 36 Basic commands, designed to take the PEEKing and POKEing out of the 64's sound and graphics facilities. These were examined last month.

Zorn is a demonstration game supplied on the cassette to illustrate what you can do with the additional Basic commands. As a game it's a complete non-starter, but the sound and graphics are quite impressive. Treat them as a bonus and you won't be disappointed.

ACOS OVERALL

ACOS+ has lot of potential... for anything from a more efficient means of saving your own programs, through database applications, to advanced disk-like adventure games. Unfortunately, you're probably going to have to write such applications yourself, as I doubt whether any software houses will be tempted to show much interest. Melbourne House itself fails to even supply a sample ACOS formatted tape in the package.

The additional Basic keywords are useful, if not spectacular. The datasette-handling facilities cannot honestly be compared to a disk drive — not even a Commodore one — but they are a definite improvement on the unadorned datasette. The package appears reliable enough, and at £7.95, who can argue?

MICRO OLYMPICS
Database Publications/£5.95

As the Olympics went their tawdry way in Los Angeles, Database was crowing that its Micro version was picking up a lot of sales in the US — it seems that the slow-moving US houses had not cashed in fast enough.

And just to add to the expected profits, Database actually sold advertising space on the screen displays. All good promotional stuff.

However...

Loading the game, without any apparent fast loading techniques took the usual long time and ended with a menu that laid out the Olympic events included. These are divided into three sections, covering running, throwing and jumping, and you are invited to pick one.

The running is done, as has been usual ever since the genre started with Microsoft's (arcade) Decathlon, by pressing two user-selected keys in succession as fast as you can. The other two types of event are different, however. Here concentration comes into play, with a little marker on the screen and an arrow. The idea is that the player demonstrates concentration by typing a four-number sequence in the right order and at the right speed to keep the arrow close to the marker. After a while of this, you can start running with the keys on the beep signal and then throw or jump with the fire key.

CLARK'S CLASSIC

I found it impossible to hit the right sequence of keys while looking at the screen, and impossible to keep the arrow close to the marker whether I was looking at the screen or not. My concentration must be defective.

The computer's, of course, is not and it is the computer who is the opponent. When you start to, say, throw the javelin, the computer says it has thrown already and asks if you would like an action replay. The computer's man is dressed in white, and yours in black, but otherwise they are identical.

It's disconcerting that the computer always throws close to the world record, shown in the top left-hand corner of the screen. Anyway, back at the javelin, you can set the throwing angle, go through your concentration routine and then start running with the keys until a beep sounds. The computer will then keep your man running, and when you reach the throw line you press the fire button to launch.

The graphics are, frankly, disappointing. At the moment of release the picture changes, the grandstand disappears, and you get a stick man throwing a stick across what looks like a piece of graph paper.

General impressions are of a clumsy package with graphics and sound that are only adequate and a 'user interface' that is frustrating rather than easy. Los Angeles it ain't. Now if they held the Olympics in Nuneaton...

TOP LEFT HAND CORNER SHOWS THE EVENT.

CURRENT WORLD RECORD FOR YOU TO COMPETE AGAINST.

THE COMPUTER, ANNOYINGLY, ALWAYS SEEMS TO SCORE CLOSE TO THE WORLD RECORD.

THIS DISPLAY SHOWS HOW FAR YOU'VE GOT LEFT TO RUN.

DATABASE ACTUALLY SOLD ADVERTISING SPACE IN THE SCREEN DISPLAY!

PERCY THE POTTY PIGEON
Gremlin Graphics £7.95

Just potty.

Driving in London has various hazards, including the pigeon's well-known aversion to flying where walking will do and thus sprinting out from under the wheels like Carl Lewis as you wait for the crunch and the blood.

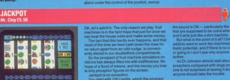
Pigeons, normally, get their revenge on the car roof during the night. Percy is a slightly different pigeon. He gets his own back by bombing passing cars.

Don't ask me where this lunatic concept comes from, ask Gremlin Graphics. Why a pigeon, concerned with building a nest by collecting twigs on the roadway and putting them in trees, should want to blow up cazs is a mystery.

Of course, in this game the bombs are an optional extra. The main aim of the pigeon is to fly about under the control of the joystick, swoop down to the road for sticks, and take them up to the nearest nest site in the roadside trees. The cars are one hazard, anJ in later levels there are sparrows who steal the twigs, hawks who steal the pigeon, aeroplanes, and similar hazards of the empyrean.

There is little else to say, except that the graphics of road, cars and pigeons are prettv good and the sound and music are fine.

But piloting a pigeon is not my idea of a good time. It's probably my fault; the game's high enough in the charts for Gremlin not to worry much about my preferences.



JACKPOT
Mr. Chip £5.50

Pretty but pointless.

OK, let's admit it. The only reason we play fruit machines is in the faint hope that just for once we can beat the house odds and make some money.

The fact that this hardly ever happens, and that most of the time we feed cash down the maw for no return apart from an odd nudge, is conveniently stored in our doublethink compartments.

So the prospect of fruit machine simulators on micros has always filled me with indifference. No hope of a flood of tokens, and the money you lose is only phosphor figures on the screen.

Jackpot is no exception.

You start with 100 credits, which the program calls pounds, and make donations to the machine in £10 lumps. Press a function key to roll, and you are in the usual simulation. Good graphics expertise has gone into the rolling reels, the sound is OK — particularly the ker-chunks that are supposed to be coins when you win — and it acts just like a slot machine.

But what is the point of it all? Only Las Vegas addicts want to work the machines for their aesthetic potential, and if there is no cash coming out or going in I don't see why anyone else should bother.

As Dr Johnson almost said about women preachers compared with dogs on their hind legs, one is not surprised at seeing it done, just at why anyone should take the trouble.

FALCON PATROL II

Virgin Games £7.95

Good blast 'em up.

Falcon Patrol 2 is, wait for it, an improved version of Falcon Patrol, released last year. Actually, the game is virtually identical, FP2 is just better implemented.

Your task, as the pilot of a Falcon fighter jet, is to ... well, I'm not quite sure what you're supposed to be achieving, but to achieve it you have to blast the hell out of any enemy helicopters that come your way. And come your way they do, in droves. The inlay card claims that the three types of helicopter behave in different ways — if there was time to hover around observing flying patterns then I'd tell you about it, but the only time I tried a bit of aviation anthropology I got blasted into the ground within a few seconds.

You have a radar display at the bottom of the screen to warn you of approaching helicopters, and other dangers to watch out for are flak batteries, though I found these pretty pathetic and probably no danger to passing pigeons, let alone jet fighters. Again the inlay card claims that the transporter helicopters will drop radar jamming devices which you have to find and destroy; if any of these jammed my radar, it wasn't for long 'cos I didn't notice it.

The action of the Falcon is about as realistic as you can expect in an arcade game — it slows down and loses height in a turn — and the 3D scenery is quite pretty. Great fun if you're into zapping things for the hell of it.

FLIP & FLOP

Statesoft £8.95

A monkey called Mitch?

This is an odd one from First Star, the people who brought us Astro Chase, via new company Statesoft. The scenario, so we are told, is that a kangaroo and a monkey are trapped in a futuristic zoo and need to escape. The kangaroo is called Flip, and the monkey, as you'd expect, is called Mitch. Huh?

That aside, this game runs in rounds, each round in two parts. First Flip has to hop from square to square on the screen, trying to jump on the highlighted ones. Then Mitch has to swing around trying to hang off the squares. And that, apart from a few obstacles like rabid zoo-keepers and flying nets, is that.

What makes this game different, and hard with it, is that the squares of the zoo are not in the plane of the screen, or even at right-angles to that plane. What you see is an isometric projection of the squares, which means — for those without a Technical Drawing 'O' Level — the screen shows a perspective view. The zoo squares are suspended in space, and in perspective.

What this means is that the four joystick movements do not give simple up-and-down and side-to-side movement, but movement at weird angles around the zoo.

The added complication is that while Flip hops around on top of the angled squares, Mitch swings around unerneath them. And this requires a sense of angles and special awareness that would get you into Mensa.

OK I suppose, but I couldn't make head or tail of it. If I was them I'd just gnaw at the bars.

ASTRO CHASE

Statesoft/£8.95



Routine save the earth stuff.

Statesoft is a new company set up to manufacture, publish and market US software titles in the UK, and Astro Chase is the first result.

The first thing to notice is that space in the vicinity of earth gets very crowded over the next few millennia. There are about half a dozen Saturns and a score of asteroids just sitting there, and experiment quickly shows that you can't fly through them. This can give some idle amusement as you ricochet round the screen, bouncing off earth and satellites with satisfying thumping noises. But when the real play starts they are a pain.

The reason for their pain-inducing potential is that controlling the saucer is not easy. Once started in a particular direction, it keeps on going in true Newtonian style until you change direction again.

This game won an award in the US last year, but I'm not sure how. Apart from the introduction the graphics are not *that* good, the music consists entirely of the 1812 Overture, and the game itself can be summed up as touring through a kind of maze under varying amounts of control, shooting at anything that moves or flashes.

DAREDEVIL DENNIS

Visions Software Factory/£7.95

Perils of the commuter run.

It seems that this is the second game in the Dennis series, but Visions still doesn't seem to have figured out how to spell his name.

The game involves Dennis, now apparently a film star, walking to work and doing a motorbike stunt. The walk to work is livened up by a parade of red balloons that Dennis has to jump up and burst, and arrays of flowers that he must avoid.

The second part, though, is like being on a different planet. Dennis is stuck on his motorbike and placed on the top level of one of those Kong-like screenfuls of floors with holes in them. A set of balloons floats down frum the roof to leave indistinct objects on various places of various levels, and Dennis has to run over them with his bike.

Of course there are obstacles, like trees, giant flowers, and apparently 68 others going through 80 levels of play. I never got to see them all, because this is *fast*. Moving the joystick to start the bike seems to fire rockets, and Dennis flies round the screen like a ball-bearing in a liquidiser.

This is an odd mixture, twee at the beginning, terrifyingly fast at the end, and with the best graphics saved for the inter-frame interludes and the flames and smoke when Dennis hits a tree.



BEAMRIDER
Activision £9.99

Grown up Space Invaders.

Nothing pretentious about this one. Remember the early arcade games, where the aim was to blast swooping aliens? Beamrider is just the same, except for what the blurb calls 3D effects and I call tilting the playing field to give perspective.

The screen is a chequerboard of glowing lines, with your ship moving from beam to beam at the bottom of the display. The aliens swirl about on the horizon, and then move down jumping from beam to beam as they do. The player has to fire missiles up the beams and hit the enemy ships as they come in.

If it sounds simple, that's because it is. The aliens occasionally fire missiles down the beams, friendly ships sometimes appear to refuel the player's ship, and so on. But this game is basically Space Invaders with perspective, an impression emphasised by the appearance of motherships moving across the top of the screen. The motherships need to be hit for big scores, but instead of the remaining aliens blocking the shots a special breed of green beam-blockers stops the player getting clear shots up the beam.

For space invader fans who have grown up, but not too much.

MERLIN
Wye Valley Software £6.95

Just like Mama used to make.

The wizard Merlin has always had problems, not least being walled up in a Cornish cave by the nymph Nimue. In this game, however, Merlin's problem is more related to Cordon Bleu than Nimue.

What the player, as the wizard, has to do is cook up a brew in the cauldron shown on the screen. The ingredients, which appear roughly randomly round the screen during play, are a frog's leg, a skull, an eye (presumably of newt), and a shimmering crystal. Merlin, mounted on what looks like a flying saucer more reminiscent of the Mekon, dives around the screen picking up ingredients for the pot, dropping them in, zapping baddies, and keeping an eye on the magic power level at the top of the screen.

Every now and again, an anti-spell floats down on a parachute into the pot and the collection of leg of dog, eye of programmer or whatever has to start again.

Why Merlin should be wasting his time cooking when Nimue is waiting in the cave is beyond me, and so is the game. It's fast, furious, and I found it damn near impossible to zap in the right direction and drop the right bits in the pot. In fact, some of pot bits were pretty similar to the baddies — particularly under pressure.

Final verdicts; it has similarities to Cookie on the Spectrum, but isn't as addictive. Still, at least Wye Valley had the guts to put four screen shots on the packaging to show what it looks like in play. Other publishers please note.

H.E.R.O.
Activision £9.99

Explosive stuff.

Yes it is set down a mine, yes you do have to descend into caverns and rescue trapped miners by going down tunnels and avoiding nasties, and all that sort of cliche stuff.

But H.E.R.O. is a winner all the way.

The scenario is that Roderick Hero — referred to throughout the manual as R. Hero (geddit?) — has been specially equipped with rescue equipment to save a careless group of miners trapped in Mount Leone by volcanic activity.

Roderick floats down the shaft under the force of gravity, then goes horizontally under control of the joystick. The first obstacle is a wall of fallen rock, but a quick jerk back on the joystick plants a stick of dynamite, and a quick move sideways with the joystick gets Roderick out of range of the blast.

There are various hazards in the mine, like vampire bats, spiders, and the usual stuff to blast. The worst though is light failure, which occurs from time to time as Roderick drops out of one screen and into the next. The luminous nasties can be seen, but not the tunnels or walls, and this is prime time for self-immolation by dynamite.

The sound is good — particularly the hissing fuses on the planted dynamite — and the graphics are the normal standard, looking like lumps of multicoloured plasticine squeezed together.

BEST OF THE REST

As Jeff Minter goes off to a well-deserved holiday in, where else, Peru, 64 owners can take a stab at his two latest Llamasoft titles. These are **Sheep in Space** (£7.50) and **Metagalactic Llamas Battle at the Edge of Time,** (£5.50) demonstrating that Minter's obsession with woolly mammals has not yet abated.

In Sheep in Space the player is, not unreasonably, a sheep. But what a sheep! This one skims across the surface of an alien space environment, landing only to refuel with grass — landing without breaking a leg is a tricky touch — and blasting the aliens out of the sky with some mutated sheep weapon or other.

In MLB at the E of T, the player mutates further into yet another llama which must stop the descending aliens.

Three new titles from Artic feature the same character in various situations, in this case Humpty Dumpty. Why Artic has gone for this harmless cartoon character and stuffed him into these three dogs is likely to remain a mystery, although I expect a Save Humpty campaign to get underway pretty damn quick.

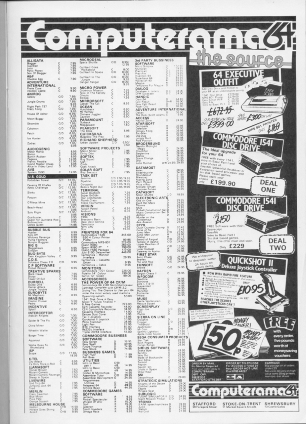
The three titles — for the record, if you have any sense you won't need them again — are **Humpty Dumpty in the Garden, Engineer Humpty,** and . . . **Humpty goes to Hollywood**? Sorry, I can't remember the third one, which had an impact on the brain. Like a polythene bag full of treacle. They cost around £17.95 for the three.

In Engineer Humpty, the aim is to drop spanners into a tool box through a maze of rotating conveyors and similar obstacles. But after finding that the first screen seemed to make it physically impossible to get the spanner anywhere, I packed it in.

In Humpty in the Garden, the aim, for want of a better word, is to water particular plants and avoid watering others. The instructions give you no idea how to control these things, with the result that disaster is not long in happening as the weeds take over. I packed it in.

And the final Humpty tale, which I can't even remember the name of, involves a maze. But just to be different, you don't move Humpty round the maze but rotate the maze and let Humpty move around by the force of gravity.

The only mercy with all three is that the music can be turned off. Oh, and the cover art is the only saving grace of the whole sorry operation.


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GOT THE BACK ISSUE BUG?

ISSUE 1

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THE PORTABLE 64 — Y64 GIVES IT THE IN-DEPTH REVIEW TREATMENT

A HACKER'S GUIDE TO TACKLING JUMPMAN — COMPLETE WITH FULL-COLOUR SCREEN SHOTS

DIY EXTENDED BASIC PACKAGE — ADDS NINE INVALUABLE KEYWORDS AND ALLOWS YOU TO DEFINE OTHERS

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PLUS COMPUTER COMMUNICATIONS EXPLAINED. ADVANCED GRAPHICS TECHNIQUES. THE ZORK ADVENTURES

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COMPLETE COMPARATIVE REVIEW OF ALL THE CBM 64 EXTENDED BASICS

CREATE NO LESS THAN 50 COLOURS ON YOUR 64!

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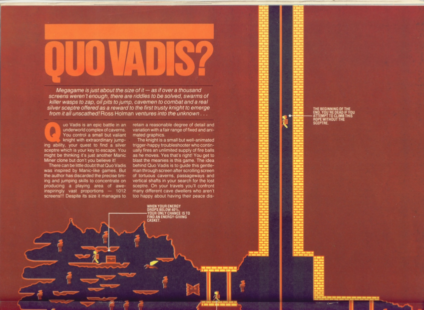
QUO VADIS?

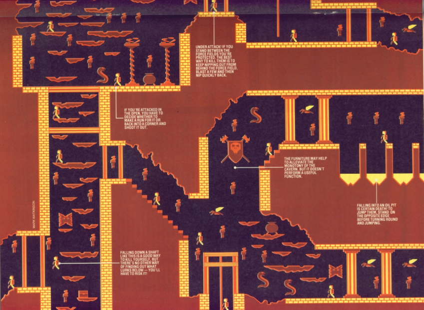
Megagame is just about the size of it — as if over a thousand screens weren't enough, there are riddles to be solved, swarms of killer wasps to zap, oil pits to jump, cavemen to combat and a real silver sceptre offered as a reward to the first trusty knight tc emerge from it all unscathed! Ross Holman ventures into the unknown . . .

Quo Vadis is an epic battle in an underworld complex of caverns. You control a small but valiant knight with extraordinary jumping ability, your quest to find a silver sceptre which is your key to escape. You might be thinking it's just another Manic Miner clone but don't you believe it!

There can be little doubt that Quo Vadis was inspired by Manic-like games. But the author has discarded the precise timing and jumping skills to concentrate on producing a playing area of awe-inspiringly vast proportions — 1012 screens!!! Despite its size it manages to retain a reasonable degree of detail and variation with a fair range of fixed and animated graphics.

The knight is a small but well-animated trigger-happy troubleshooter who continually fires an unlimited supply of fire balls as he moves. Yes that's right! You get to blast the meanies is this game. The idea behind Quo Vadis is to guide this gentleman through screen after scrolling screen of tortuous caverns, passageways and vertical shafts in your search for the lost sceptre. On your travels you'll confront many different cave dwellers who aren't too happy about having their peace dis-




UNDER ATTACK! IF YOU STAND BETWEEN THE FORCE FIELDS YOU'RE PROTECTED. THE BEST WAY TO KILL THEM IS TO KEEP NIPPING OUT FROM BEHIND THE FORCE FIELD, BLAST A FEW AND THEN NIP QUICKLY BACK.
IF YOU'RE ATTACKED IN THE OPEN, YOU HAVE TO DECIDE WHETHER TO MAKE A RUN FOR IT OR BACK INTO A CORNER AND SHOOT IT OUT.
THE FURNITURE MAY HELP TO ALLEVIATE THE MONOTONY OF THE CAVERN, BUT IT DOESN'T PERFORM A USEFUL FUNCTION.
FALLING INTO AN OIL PIT IS CERTAIN DEATH! TO JUMP THEM, STAND ON THE OPPOSITE EDGE BEFORE TURNING ROUND AND JUMPING.
FALLING DOWN A SHAFT LIKE THIS IS A GOOD WAY TO KILL YOURSELF, BUT THERE'S NO OTHER WAY OF FINDING OUT WHAT LURKS BELOW — YOU'LL HAVE TO RISK IT!
MARK WATKINSON

QUO VADIS?

turbed: it's invariably best to shoot these. If one of these undesirables does hit you he'll sap some of your strength: falling into oil pits also has this effect. Your percentage strength and score can be reviewed by pressing RETURN. This is a useful ruse as it pauses the action until you hit RETURN again! The only other things between you and ultimate success are the oil pits, which need to be carefully jumped, and the sheer size of the playing area. So what's it like to play?

Quo Vadis must be a fairly enormous program, but thankfully uses one of the many super fast loaders, so loading takes only 3 minutes. This done, a filtered tune emanates from the speaker and on pressing "S" to start the game, you realise there's no way to stop it — except of course by turning down the volume. This isn't such a difficult task but it does mean that all those wonderful explosive sound effects are lost. Not having any instructions, I spent the first couple of goes falling off the rope you start on and into an oil pit, but I soon discovered the merits of the diagonals for controlling the man.

Due to the nature of the game, jumping with shooting, the author has found an efficient way of combining all the necessary movements using the joystick's eight directions and fire button. No keyboard control was catered for on my copy. Firstly left/right/up/down will move you in the appropriate direction, firing continuously. The up diagonals jump you diagonally while firing, and pressing the fire button stops your man moving, allowing you to fire in any of the eight directions. The joystick response was very good, though I did find I sometimes unintentionally released the pressure on the fire button and suddenly leapt into a swarm of vicious wasps (if that's what they are). Hitting the diagonal to jump was also tricky at times, although pressing the fire button before selecting the diagonal and then releasing it afterwards achieved the desired results, but this slowed the action somewhat.

Having mastered the controls I began to explore a little. I soon noticed I was not alone; the aforementioned killer wasps were after me! Ducking behind a protective force field caused them to promptly disintegrate only to reappear as I emerged again. Standing my ground, I decided to shoot it out and my efforts were duly rewarded as the last one was splattered by a fire ball. I now appeared free to roam about unmolested in a large cavern and my strength was still at 76%. A shaft lead downwards but I chose to ignore it, intrigued as to where the rocky platforms would lead, and whether they would prove as difficult to negotiate as those in Manic Miner and the likes. My rapid ascent to a high rocky roof showed my fears to be unfounded, there being more than enough platforms to allow many different routes, although the cursor scrolling doesn't allow the pixel-precision jumps found in many other games. Still, all was well as I came across a casket, which, once walked across, increased my strength no end. I made another discovery shortly after falling off a platform and landing on the cavern floor far below, which was that you can do just that sort of thing without any ill effects whatsoever. Venturing onward and downward, I came to a series of pillars separated by boiling lava pools. My first attempts to negotiate these ended in my rapid death. After a few goes, however, I learnt the knack of getting over them: the only way to clear these appears to be to stand on the opposite edge of each pillar, facing the way you came, then jumping. Try it, it works!

In subsequent games I encountered burning torches, both large and small, cauldrons, large Greek pillars, staircases, rocky tunnels and all manner of fire-spitting evil creatures.

Due to the size of the playing area, some repetition of graphics is inevitable. The main blocks that make up the tunnels, such as brickwork and ragged rocky outcrops, can be seen repeating frequently, as can the objects furnishing the caves. This of course tends to mean that you see nothing new after exploring the first few caverns nearest the entrance. In its favour though is the attractive animation, such as the bubbling oil pits which really don't look at all inviting and the varied way in which the author has combined the standard blocks to the best overall design — which does maintain interest. The various cave inhabitants liven up the game until you kill or outrun them all, and the writing on the walls is very intriguing...

All in all, Quo Vadis is one of the best games I've seen on the 64. The display is very clear with no flicker, the sprites are just difficult and attractive enough to hold your attention while the sheer enormity of the cave complex could take weeks to explore. Without a map the game has little appeal as you don't get much out of wandering around aimlessly, you just get lost and very confused! But for those who accept the challenge of mapping the terrain, it can become a pernicious addiction.



Pressing RETURN gives you your score



You have to leap from platform to platform

Y64 DATACARD

NAME:	QUO VADIS
SUPPLIER:	THE EDGE 01-240 1422
PRICE:	£9.95
TYPE OF GAME:	ARCADE
MEDIA:	CASSETTE/DISK SOON
REVIEW COPY OBTAINED FROM:	THE EDGE

FIND THE SCEPTRE!

The game may be fantasy, but the silver sceptre is for real. The Edge has commissioned a real sceptre — worth £10,000 — to present to the first person to solve the game!

The sceptre, made from silver, rosewood, rock crystal and gold, will be awarded to the first person to find the sceptre in the game and solve all the riddles along the way. To claim the prize, though, you'll have to prove that you did it the hard way by presenting The Edge with a full map of the game.

Whether this incentive will have quite the same effect as the famous golden hare of the childrens' book *Masquerade* remains to be seen, but I think it will keep a few people up through the night!



Once you're here you're there! The screen version...



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TOOL KITS

Following up on last month's comparative reviews of all the extended Basic packages for the 64, Keith Bowden turns his attention to the three toolkits available.

Toolkits are packages which add extra commands to aid program development. Their purpose is simply to make life easier for the programmer by providing routines which should really be standard on any micro. Typical toolkit commands include RENUMBER, DELETE and MERGE.

Power 64 is a powerful Basic toolkit, originally written for the PET over five years ago and marketed in the States by Proline Software; now it's available over here from Kobra for £39 plus VAT. Until recently the package was marked up at an extravagant £79 . . . now, the £40 decrease makes it the cheapest around. It comes on disk (alongside a luxuriously ring-bound A4 manual) and helps remove the tedium from all those old-fashioned Basic V2 commands. Ironically though, it now looks rather old-fashioned itself.

The package consists of two programs. First there's Power 64 which extends Basic with commands such as AUTO, DELETE, RENUMBER, SEARCH-AND-REPLACE, WHY, DUMP, and TRACE. It also provides quick Spectrum-like keystrokes for Basic — for example shift-L for LIST (which is a bit silly when you consider that the 64 already has a similar system — L shift-I). ,

TEST allows you to have two Basic programs in memory at once. A sophisticated facility is also provided that allows you to define your own function keys. The definitions are included in the Basic program as REM statements and so can be saved with it. However, the single most useful facility for the 64 is probably its ability to scroll Basic programs down as well as up — by holding down the appropriate cursor key. This gives the Commodore 64 one of the most powerful screen editors available.

The second program in the package, MorePower, can be run simultaneously with the first and adds simplified disk handling commands to the 64. These include HEX, MERGE and UNDO (OLD), and there are extended RUN and LIST facilities. Hitting a function key to get a disk directory without destroying your current Basic program is also a boon, and the EXEC command (which passes control of the computer to a sequential disk file) is excellent. My Power disk now boots Power, MorePower, Supermon and PAL; all sit in memory alongside my own programs (which, by the way, isn't that easy to achieve, as the disks supplied are copy-protected).

The ability to run Proline's PAL assembler under Power makes it possibly the most sophisticated assembler development system on the market. Theoretically Power is compatible with other programs in the same way, but there've been problems getting it to run with any of the graphics extensions. The package comes on disk and is supplied with a rather pretentious manual by Commodore's PET man, Jim Butterworth. The documentation is adequate.

Power 64 has gone through a substantial price reduction. When I first started using it I thought it could do with a serious update; since then, the more I use it the better it seems to be.

The Victree and Softchip cartridges take a totally different approach to Power 64: they both attempt to reproduce the Basic 4 commands now supplied with Commodore's old PET machines. Victree, an American product from Skyles Electric Works in California, is distributed by Supersoft in England. Softchip comes from Whitby Computers (in Whitby, no less).

Softchip is rather unusual in that it can be customised to the user's requirements. Whitby supplies a list of the commands it supports and the number of bytes each takes up; you choose the commands you want — subject to available memory. The review copy was the 'default' selection, known as The Programmer's Friend.

The two cartridges are very similar to one another, but with Victree offering more facilities; both have default parameters for all commands. The Victree documentation is also the better presented of the two.

Both cartridges offer a large selection of disk and editing commands, including BACKUP (a hangover from the PET, since it only works with a 4040 double drive). Actually, Victree comes out best on the editing commands, although all three packages contain everything that's essential. Victree has a crude wordprocessing mode that uses the Basic line editor; however it lacks OLD and function key definitions (which are included in the other two). Softchip contains a tiny built-in machine code monitor, but with no assembler or disassembler. All three toolkits have some debugging and control commands, with Power coming out ahead of the other two. Both Power 64 and Softchip allow you to add your own commands.

Decisions, Decisions

If you're thinking about compatibility with PET machines, then go for the Victree . . . it's got most of the Basic 4 commands, and many extras besides. If you just want a straight toolkit, then Power is the more powerful and its relatively few commands do much more than you'd expect. At the touch of a function key, whole subroutines can be defined and displayed, or obeyed. Function keys can be saved along with a program and the scrolling is of a standard normally only seen on wordprocessors.

Power's EXEC command allows the disk drive to take over entire control of the computer. It'll load a program and run it, supply data to it, delete it and load and run another one. It'll even define function keys! The search and replace functions work globally and allow multiple wildcards! To add commands to Basic using Softchip, you have to program in machine code while with Power 64 it can be done in Basic.

THE TOOLKIT SUPPLIERS

Package	Supplier	Keywords Added	Price
Victree	Supersoft, 01-861 1166	42	£50.00
Softchip 64 (Default)	Whitby Computers, 0947-604966	34	£29.95
Softchip 64 (User-defined)	Whitby Computers, 0947-604966	Variable	£34.95
Power 64	Kobra Marketing, 0491-572512	28	£45.00

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PROGRAMMING



PART 3:

- The accumulator and X & Y registers.
- Some simple machine code commands: LDA, LDX, LDY, STA, STX, STY, RTS, CMP, BEQ, BNE
- Where to place machine code programs in memory.
- Writing our first machine code program.
- Homework: writing your first machine code program.

In Part 1 we introduced the hexadecimal numbering system used in writing machine code programs. This base 16 system is used because any byte between 0 and 255 can be represented in just two hex digits ($0 to $FF). By extending this to four hex digits (that is, two bytes) we can represent any number up to $FFFF — decimal 65536, or 64K. Thus we can address any location in the 64's RAM using just two bytes. All values and memory locations used in machine code are expressed in hexadecimal form for this reason. Hex numbers are preceded by a dollar sign ('$') to differentiate them from decimal numbers.

Machine code per se also uses hex numbers to represent instructions. Because humans find numbers harder to grapple with than words, a system known as assembly language, or assembler, was devised. This uses 3-letter instructions in place of hex instructions. Assembly language is what most people mean by machine code and is what we are teaching here.

In order to program in assembly language you'll need to buy an assembler. This is the program which accepts our assembly language instructions — known as the source code — and turns it into machine code — known as object code. There are two types of assemblers, simple and full. The most important practical difference between the two is that full assemblers allow our assembly language programs to be edited while simple assemblers do not. To help you choose an assembler, part 2 of our course examined six popular packages and included a money-saving coupon for four of them. So far in the series, we've looked at what we mean by assembly language and machine code, the hexadecimal numbering system and taken a look at some popular assemblers for the 64. This month we're going to put all this knowledge to good use and begin writing machine code! (This assumes, of course, that you've all done your homework and bought an assembler.)

There are a number of different assemblers available for the 64, and they all use different methods for entering source code. Obviously we can't use all the different notations, so we'll be as general as possible: for the exact syntax, please refer to the instructions supplied with your assembler. If you all did as I suggested last month, and tried out all the demo programs, you should be pretty familiar with its notation.

Manipulators

So, let's get down to business. In a nutshell, programming is nothing more than the manipulation of the contents of memory locations. In Basic, most of this manipulation is performed using variables, while in machine code we act directly on memory addresses using what are known as 'manipulators'. There are three manipulators, and we're going to start by looking at the most important of them — the accumulator. In the examples that follow, we've included equivalent code written in Basic: please note that these are intended to illustrate the *concept* involved — the Basic version does *not* directly relate to the assembly language code. The exclamation mark (pronounced 'pling') is the assembler equivalent of REM, by the way.

The accumulator can be thought of as a variable. You can store values in it and you can transfer the contents of the accumulator into a memory location. This is done with the two machine code commands LDA and STA.

LDA stands for LoaD Accumulator and its simplest use is LDA <value> which puts the specified value into the accumulator. Thus:

```
LDA #$01 !LET A=1
```

puts the value 1 into the accumulator. Remember that the '#' (pronounced 'hash') sign tells the assembler that you mean the value 1 and not the contents of memory location 1. The dollar sign simply specifies that you mean hexadecimal 1 and not decimal 1 (though in this particular case the two are the same, of course — one unit is the same in any base). To place the contents of memory location 1 into the accumulator we would write:

```
LDA $01 ! LET B=PEEK(1)
```

STA stands for STore the contents of the Accumulator and its simplest use is STA <address> which puts the current value of the accumulator into the specified memory location. Thus:

```
STA $0400 !POKE 1024, B
```

makes memory location $0400 (decimal 1024) equal to the current value of the accumulator. Note that the accumulator retains its value when an STA is performed.

There are two other manipulators, known as the X index and Y index. Although these differ from the accumulator in ways which we will examine later in the series, the principle is the same. LDX <value> places the specified value into the X index, and LDY <value> does the same for the Y index. Similarly, STX <address> puts the current value of the X index into the specified address, and STY <address> the same for the Y index. Thus:

```
LDX #$20  !LoaD X index with $20
STX $0400 !STore value of X index at $0400
```

would place the value $20 at address $0400.

Our First Program

OK, we already know enough to write our first machine code program, so let's do so. First of all tell your assembler where in RAM the finished program is to be placed. This is normally done by an asterisk followed by the start address:

```
* = C000
```

Consult your assembler's manual if in doubt, and enter $C000 as the start address (49152, if your assembler wants the address in decimal form). We're now ready to write the first line of our program:

```
LDA #$01
```

places the value 1 into the accumulator. The next line:

```
STA $0400
```

places the value of the accumulator (that is, 1) into address $0400. If you take a look at Appendix E of the 64 User Manual (p132), you'll see that character code 1 is 'A' (note that character codes are *not* the same as the ASCII character set). If you now refer to the memory map in last month's tutor (issue 2, p35) you can see that $0400 is the start of the screen

A DETAILED MEMORY MAP SHOWING OVERLAYS

8K KERNAL ROM
57344 $E000

4K CHARACTER ROM
53248 $D000

8K BASIC ROM
40960 $A000

8K CARTRIDGE
32768 $8000

8K RAM
57344 $E000

4K I/O RAM
53248 $D000

4K RAM
49152 $C000

8K RAM
40960 $A000

8K RAM
32768 $8000

8K RAM
24576 $6000

8K RAM
16384 $4000

8K RAM
8192 $2000

6K RAM
2048 $0800

RESERVED RAM SCREEN MEMORY AND SPRITE POINTERS (SEE PART 1)

VIDEO CHIP
$D000 TO $D02E

SID CHIP
$D400 TO $D7FF

COLOUR RAM
$D800 TO $DBFF

INTERFACES
$DC00 TO $DFFF

Something which often puzzles those new to the 64 is how it is possible to address 64K RAM plus 20K ROM using only the locations $0 to $FFFF.

This feat is achieved by virtue of a system known as 'paged' memory. Under this system, the 20K ROM sits 'on top of' parts of the 64K RAM. On power-up, you get the memory contents shown immediately to the left. As you can see, the Kernal and Basic ROMs overlay a total of 16K RAM. If you want to access any of this 16K, you have to 'page out' the ROM and 'page in' the RAM. Similarly, if you have a cartridge plugged in on power-up, the 64 will automatically page this in so that the cartridge program occupies $8000 to $A000. The alternative contents for each memory location are shown on the far left.

The system is also known as 'banked' memory and hence switching between the two banks as bank-switching. Those of you who have designed your own character sets will already be familiar with the process of paging in the character ROM at $D000 to $E000 (a Basic program to do this is given on page 110 of the Programmer's Reference Guide).

Bank switching may be done manually, but for most purposes is performed automatically by the 64.

MARK WATKINSON

RAM. In other words, we've placed a letter 'A' into the top left hand corner of the screen.

This, however, is not quite enough. Since we haven't specified a colour for our 'A' the 64 will assume that we want to use the default, which happens to be the same as the background colour. Blue on blue not being noted for its readability, it would help if we chose a different colour. Those of you used to POKEing to the screen will know that you have to POKE not only the character, but also the colour code. For the benefit of those not familiar with this technique, let's just take a paragraph to


SABRE
WULF

OUR FIRST MACHINE CODE PROGRAM

```
*=C000       !Specify start address
LDA #$01     !Make accumulator equal $01
STA $0400    !Place the value of the accumulator into the start of screen RAM
STA $D800    !Place the value of the accumulator into the start of screen RAM
RTS          !Return to Basic
```

Firstly we tell the assembler where we want to place our machine code program. In most cases, this is done by an asterisk followed by the start address. Next we place the value 1 into the accumulator. This value is placed into the start of screen RAM; $0400 is the top left hand corner of the screen, and $01 represents the letter 'A'. We then place the value 1 into the start of colour RAM; $D800 is the top left hand corner of colour memory, and $01 represents the colour white. Finally the RTS statement tells the 64 to return to Basic.

The same program written using labels

```
*=$C000           !Start address
SCREEN=$0400      !Top left of screen RAM
COLOUR=$D800      !Top left of colour RAM
LETTERA=$01       !The character 'A'
LDA #LETTERA      !Make accumulator $01
STA SCREEN        !Make SCREEN=accumulator
STA COLOUR        !Make COLOUR=accumulator
RTS               !Return to Basic
```

see how it works.

From the memory map we can see that the screen RAM (also known as video RAM) occupies $0400 to $07F8 — one byte for each of the 1000 (25 lines of 40 columns) character positions on the screen plus 16 unused bytes. A detailed screen memory map is given in Appendix G of your User Manual (page 138), though since this is in decimal you'll need to convert the values to hex if it's to be much use to you for machine code purposes. However, the *Y64* memory map published in issue 2 doesn't appear to show the colour RAM. This is because the colour RAM sits in $D800 to $DBFF *underneath* part of the character ROM ($D000 to $E000). You don't need to understand how the same memory can be used for two different purposes at this stage, but for those who want to satisfy their curiosity, it's explained in the detailed memory map.

To set the colour of a particular character position, we have to place the colour code into the memory address corresponding to this position. In this case, we want the top left hand position in the colour RAM, which is $D800. Thus the third line of our program would read:

```
STA $D800
```

Notice that we haven't reloaded the accumulator, so it will still contain the value 1 which we set in the first line of our program. If you look at the table given on page 139 of the User Manual, you'll see that the colour corresponding to 1 is white. Thus we have set the character sitting in the top left hand corner of the screen to white.

One final line is necessary to complete the program, and that is an RTS. RTS stands for ReTurn from Subroutine, and is similar to the Basic RETURN statement. "But," you may ask, "return from what subroutine? We're not in a subroutine." An RTS encountered outside a subroutine is known as an 'extra RTS' and is used to return to Basic from machine code. So, let's add this line:

```
RTS
```

and we've written our first machine code program! Now all we have to do is to assemble it (again, consult your assembler's manual for this). Once the program has been assembled (it won't take long), return to Basic, press CLR, press RETURN 12 or 13 times to move the cursor to the middle of the screen and type:

```
SYS 49152
```

This command tells the 64 to RUN the machine code program starting at address 49152 (the decimal equivalent of $C000). You should now see a white 'A' appear at the top left hand corner of the screen.

Gratifying as that my have been, it isn't exactly exciting:

```
10 POKE 1024,1:POKE 55296,1
```

does the same thing in Basic using two POKEs. The technique is, of course, the same: we POKE the character code for the letter 'A' into the appropriate screen location, and POKE the colour white into the appropriate colour RAM location. Once we've got a little further into the course we'll start do to things which can't be done using Basic — that is, after all, the point of learning machine code, but let's take things a step at a time!

Labels

One of the difficulties in getting used to machine code programming is remembering all those unfamiliar hex addresses. If you've worked through the examples in your assembler's manual as well as those given here, you'll probably have the addresses $C000 (the start address for most machine code programs), $0400 (the start of screen RAM) and $55296 (the start of colour RAM) permanently embedded in your brain. Other addresses, however, may be more difficult to remember — particularly if you're unused to hex. To make assembly language programs more readable, therefore, we suggest that you get into the habit of using labels.

Labels are just names given to variables. In a Basic program, for example, instead of having a couple of lines that read:

```
340 FOR A=55736 TO 56295:POKE A,10:NEXT
350 FOR A=1024 TO 2023:POKE A,1:NEXT
```

we could use variables to make things a little more readable:

```
10 RED=10:CAPITALA=1
20 COLOUR=55296:SCREEN=1024
```

Now we can write:

```
340 FOR A=COLOUR+443 TO COLOUR+999:POKE
A,RED:NEXT
350 FOR A=SCREEN TO SCREEN+999:POKE A,C
APITALA:NEXT
```

The second version is much easier to follow (it POKEs the colour red into the colour RAM for the bottom half of the screen then POKEs 'A's into the video RAM).

Likewise in a machine code program we can use labels in place of values. But there is another reason to use labels when writing in assembly language: when you make branches (like the Basic GOTO), you don't know where in memory you'll be branching to since the assembler only works this out when assembling the program. We'll see an example of this when we look at branching in a second. Firstly, though, take a look at the two listings in the 'Our first machine code program' box. The first is the listing we've just typed in, and the second is the same program written using labels and remarks.

Decisions, Decisions

Most Basic programs are, of course, based around decisions. These are made by comparing string and numeric values using the IF-THEN and the ON-

<value>-GOTO-<line> constructs. If one expression is true the program will do one thing, if another is true the program does something else. This is true of most programming languages and machine code is no exception. So let's see how we make decisions and carry out branching in machine code.

Comparisons in machine code are made using the CMP (CoMPare) instruction. CMP <value> compares the specified value with the value of the accumulator. CMP <address> compares the value (content) of the specified address with the accumulator. Thus:

```
CMP #$60
```

compares the accumulator with the number $60, while

```
CMP $60
```

compares the accumulator with the value of memory location $60.

Now we know how to instruct the 64 to compare the accumulator with a value or address, but how do we find out the result of the comparison? So far all we know is that the comparison has been carried out. Well, there are three possible results when you compare the two values A and B: (1) they're equal; (2) A is greater than B; (3) B is greater than A. Assembly lanuage allows us to test for any of these, plus (4) A and B not equal (that is, either (2) or (3)). This month we're only concerned with equal or not-equal: we'll come to greater-than and less-than next month.

Let's look firstly at how we test whether two values are equal. Suppose we want to check whether address $60 contains the value $10. Firstly we load the accumulator to the value of address $60:


```
LDA $60
```

Next we compare the accumulator with the value #$10:

```
CMP #$10
```

Then we have to decide where we want to branch to if the two are equal. In Basic we would write:

```
IF PEEK(96)=16 THEN GOTO G
```

Similarly, the final part of our assembler comparison is:

```
BEQ G
```

BEQ stands for Branch if EQual, so if the comparison was true (that is, $60 is equal to £$10), then the program would branch to the part of the program labelled G. We'll look at this type of labelling in a moment.

The complement of BEQ is BNE (Branch is Not Equal). Thus to test for $60 and £$10 not equal:

```
LDA $60
CMP #$10
BNE H
```

So, let's do something mildly useful. The following program waits for a key to be pressed and then returns to Basic:

```
PRESSKEY LDA $C5
         CMP #$40
         BEQ PRESSKEY
         RTS
```

The first line contains the label PRESSKEY. This acts like a Basic line number — it's just a place in the program that we can jump to by specifying the label. We then load the accumulator with the content of location $C5. This location is used by the 64 to tell whether a key is being pressed. When no key is depressed, the address contains the rather appropriate value $40 (decimal 64). When a key is pressed, the location is set to the value of the key.

The second line simply compares the value of this location with $40 — the 'no keypress' value. If the two are equal (meaning no key has been pressed), the comparison is set to 'equal'.

The third line checks this and branches back to PRESSKEY (the first line) to repeat the test. If, however, a key was pressed then $C5 will not equal $40, the BEQ test will fail and control will be passed to the next line in the program

The final line, which is reached only when a key is pressed, instructs the 64 to return to Basic.

Since we can use the X and Y indexes instead of the accumulator (LDX, LDY, STX, STY) we must be able to compare values with these. This is done using CPX and CPY respectively. Thus we could have written the above program as either:

```
PRESSKEY LDX $C5
         CPX #$40
         BEQ PRESSKEY
         RTS
```

or

```
PRESSKEY LDY $C5
         CPY #$40
         BEQ PRESSKEY
         RTS
```

Remember This

The last thing we need to mention this month is memory. When writing large Basic programs, you need to keep an eye on how much memory you're using. In machine code, however, memory is much more critical since you have to be careful not to clash with any of the 64's built-in routines which you may need. Your assembler will usually tell you how much memory your program occupies when you assemble it, but it's also useful to be able to keep an eye on the size of a program as you write it. Fortunately, this is easy enough to do.

Each assembly language instruction (eg. BNE) is turned into its machine code equivalent and thus occupies one byte ($D0, in the case of BNE). We'll give you a complete table of assembly language instructions and their hex equivalents when we've introduced a few more instructions. Similarly, values up to $FF (decimal 255) occupy a single byte. "But," you ask, "how do we store numbers larger than $FF if each address can hold only one byte? How do we store $0400, for example?" Well, the most sensible solution would seem to be to split the number into two parts — in the case of $0400, $04 and $00. This is in fact exactly what happens. Technically, the 64 expects to be given the statement LDA $04000 as LDA $00 $04 This is known as low-order, high-order (or lo-hi) addressing. Thus numbers greater than $FF occupy two bytes. Fortunately assemblers convert hex numbers into lo-hi form automatically, so it's not something we need worry about for the moment. We will, however, look at this in detail later in the series.

Homework

So far we've covered some of the most important assembly language instructions available to us. Later in the Tutor we'll be building on these, so between now and next month try to familiarise yourself with them as much as possible — experiment! Here's a task to start you off: write a machine code program to write the word 'HELLO' at the top left hand corner of the screen with each letter in a different colour. If you've worked through the examples we've given this month, you should find this quite easy. Answer next month.

NEXT MONTH: FLAGS & COMPARISONS

- Plenty of examples
- How to use the X & Y indices (indexed addressing)
- Greater-than and less-than comparisons
- An introduction to flags



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GRAMMAR SCHOOL

Grammar is one of those subjects that almost everyone seems to find deathly boring. Teaching a computer to write poetry sounds rather more interesting. Harvey Mellar *explains how one can lead to the other.*

If English grammar sounds to you just about as exciting as Uncle Ben's polished white rice, here's a fascinating new way of approaching that traditionally rather boring subject. It's the brainchild of Mike Sharples, researcher in artificial intelligence at Edinburgh University, and his idea is to give students a set of computer tools with which to explore grammar. This month I'll be looking at the earlier part of his project (Poetry from Logo)

The 'Poetry from Logo' project centred around the development of poetry-writing programs, but the ulterior motive was to encourage students to clarify their ideas about English — teaching them to program was just a side issue. The Logo programs themselves rely heavily on list processing and recursion (that is, procedures that call themselves) and in fact they illustrate these facilities rather well. Similar programs in Basic would have to be far more complicated, and correspondingly more difficult to understand or modify.

A couple of minor points before we start: firstly, I won't be dealing here with whole poems, but rather just with single lines of text (the principle is easy enough to extend to more than one line, whether poetry or prose); secondly, my programs will use a number of common procedures (see Figure 4) that aren't given as primitives in Logo (their actual generation is irrelevant to the programs being developed).

Poetry At Random

So, how is a computer going to be persuaded to write us lines of deathless prose or poetry? Well, one of Mike's pupils came up with the suggestion of just picking words at random from a list — and that seemed like a good start. Figure 1 shows what our first set of procedures does.

To begin with you need a list of words for the computer to choose from. ADDWORDS1 does this, so

```
ADDWORDS1 [MARTIAN MAN ROBOT]
```

adds the list [MARTIAN MAN ROBOT] to the list called WORDS. The procedure works by first checking to see if the variable aleady exists. If it doesn't then an 'empty list' is created and the new words are added to it.

For a nine-word line you type POEM1 9, and the procedure prints a space followed by a word (selected at random from the list). Then it calls itself recursively, asking for a line of eight words, then seven, and so on — until we need a line of zero words, at which point the whole thing stops. It could, of course, have been written without using recursion, but the solution fits in better with my program development. When I tried my own set of words on POEM1 9, I got things like:

```
APPARITION LOUDLY SPOKE SPLENDID
PARANOID PLANET TERRIFIED THE WITH.
GREEN APPARITION QUIETLY THE A WITH
SPOKE TERRIFIED FLEW. FLOATING PARANOID
ROBOT MAN FLEW SPOKE FLOATING LOUDLY
TERRIFIED.
```

which is perhaps interesting but still gobbledygook.

Adding Grammar

It's clear the major problem so far is that all we get is nonsensical combinations of words like 'TERRIFIED THE WITH'. To overcome this difficulty, first we must ask ourselves *why* it doesn't make any sense. Most of you will probably remember bits and pieces of grammar from your school days; those who managed to avoid such drudgery have probably invented grammatical concepts of their own. For many, it can come as quite a shock to discover that grammar is in fact important. A partial solution here is simply to introduce some rudimentary grammar, so that an article (like THE) can only precede a noun (like ROBOT) and on no account a preposition (like WITH).

> *"It can come as quite a shock to discover that grammar is important."*

The next set of procedures (Figure 2) builds on the ones we used before, and introduces 'parts of speech'. ADDWORDS2 needs two inputs, the part of speech and a list of words to add to its list. For example:

```
ADDWORDS2 "NOUN [MAN ROBOT MARTIAN].
```

Now there's a list of words for each part of speech.

POEM2 needs a 'template' of the sentence we require... for instance:

```
POEM2 [ART ADJ NOUN ADV VERB PREP ART
ADJ NOUN]
```

This means we're after a line with the pattern <article adjective noun adverb verb preposition article adjective noun>; an example of this would be 'the green Martian quietly laughed at the terrified man'. ADDWORDS2 works pretty much like ADDWORDS1, but with the added complication of adding the words to the correct list; POEM2 takes us step-by-step through the template calling on POEM2. 1 to fetch a random word of the correct part of speech.

At this point, students are asked to make their own templates, think up their own classifications — and correct the results to bring home the importance (and the pitfalls) of classifying words. Using the same vocabulary under the refined system, I ended up with:

```
A GREEN PLANET LOUDLY SPUN UNDER A PAR-
ANOID DOME. THE TERRIFIED PLANET LOUDLY
WALKED UNDER A GREEN MARTIAN. A
PARANOID PLANET QUICKLY SPUN TOWARDS
A FLOATING MAN. THE FLOATING MARTIAN
QUICKLY WALKED AT THE GREEN MAN. THE
FLOATING MAN QUICKLY SPOKE IN THE GREEN
DOME
```

Some of this sounds vaguely feasible, and now and again even makes sense: however, there's still much to be done.

Adding Meaning

So what more do you want? Well, for a start it doesn't mean a lot; we all know about green Martians, but green men could be more of a problem. Also, planets don't spin loudly, and they're not usually paranoid — let alone terrified!

So how do we go about adding meaning to the sentences? Mike Sharples decided to associate a set of 'meaning words' with

each word — 'see', 'hear', 'abstract', 'thing', 'alive', 'moving'. Next he set up a 'pool' of the meaning words associated with the words already in the sentence. Therefore, when a new word is to be chosen, the 'meaning' words of the possible candidates are compared with the pool, and the one with the greatest overlap gets printed.

Now we've got a series of lists — one for each part of speech; it's similar to last time, only the structure is now more complex. This NOUN could look something like:

```
[MARTIAN [INTELLIGENCE MOVING HEAR SEE
GROUND]] [DOME [THING GROUND STILL
SEE]] [SHIP [THING MOVING SPACE SEE]]
```

... a list of lists. The first element is the list [MARTIAN [INTELLIGENCE MOVING HEAR SEE GROUND]]. This in turn con-

Poetry from Logo: the listings

Writing a program to generate meaningful sentences is simply a matter of applying the rules of grammar to a dictionary of words. Logo is an ideal language for this type of application because of its list-processing facilities. The complete program is constructed from a few short procedures — considerably more efficient than an equivalent Basic program.

```
TO ADDWORDS1 : LIST
  IF NOT THING? "WORDS THEN MAKE "WORDS []
  MAKE "WORDS SENTENCE :LIST :WORDS
END
TO POEM1 :LENGTH
  IF: LENGTH = 0 THEN PRINT "STOP
  (PRINT1 " " GETRANDOM :WORDS)
  POEM1 :LENGTH — 1
END
```

ADDWORDS takes a list of words as its argument and adds them to the dictionary. POEM1 takes the length of the sentence as its argument and then picks random words from the dictionary until it has produced a 'sentence' of the desired length.

```
TO ADDWORDS2 :PART :LIST
  IF NOT THING? :PART THEN MAKE :PART[]
  MAKE :PART SENTENCE :LIST THING :PART
END

TO POEM2 :TEMPLATE
  IF EMPTY? :TEMPLATE PRINT "STOP
  POEM2.1 FIRST :TEMPLATE
  POEM2 BUTFIRST :TEMPLATE
END

TO POEM2.1: WRD
  (PRINT1 " " GETRANDOM THING :WRD)
END
```

ADDWORDS2 is a more sophisticated form of ADDWORDS. It requests the part of speech followed by a list of words (for example, VERB [RUN WALK DANCE]). It then builds a more structured dictionary. POEM2 takes a 'template' of the desired sentence as its argument (for example, ARTicle ADJective NOUN VERB ADVerb). It then produces a sentence which fits this template by drawing on words from each part of its dictionary.

```
TO ADDWORDS3 :PART :WORD :MEANINGS
  IF NOT THING? :PART THEN MAKE :PART[]
  MAKE :PART FPUT (LIST :WORD :MEANINGS) THING :PART
END
```

ADDWORDS3 requires a part of speech, an example and a list of meaning words (see main text for an example). It can thus add meaning to the sentences it produces.

```
TO POEM3 :TEMPLATE
  MAKE "POOL[[]]
  POEM3.1 :TEMPLATE
END
```

POEM3 creates an empty pool, gets the template from the user and calls POEM3.1.

```
TO POEM3.1 :TEMPLATE
  IF EMPTY? :TEMPLATE THEN PRINT "STOP
  POEM3.2 FIRST :TEMPLATE
  POEM3.1 BUTFIRST :TEMPLATE
END
```

POEM3.1 accepts the template and produces each element of the sentence and passes them to POEM3.2.

```
TO POEM3.2 :WRD
  LOCAL "BEST
  MAKE "BEST BESTMATCH THING :WRD 0 []
  (PRINT1 " " FIRST :BEST)
  CHANGEPOOL :WRD :BEST
END
```

POEM3.2 is the control program for BESTMATCH and CHANGEPOOL.

```
TO BESTMATCH :ALIST :MAX :BESTLIST
  IF (ANYOF EMPTY? :ALIST EMPTY? FIRST:POOL)
    THEN OUTPUT GETRANDOM :BESTLIST
  LOCAL "NO
  MAKE "NO COUNT (INTERSECT LAST FIRST :ALIST FIRST :POOL )
  IF :NO > :MAX
    THEN MAKE "BESTLIST (LIST FIRST : ALIST) MAKE "MAX :NO
   IF :NO = :MAX
    THEN MAKE "BESTLIST FPUT FIRST :ALIST :BESTLIST
  OUTPUT BESTMATCH BUTFIRST :ALIST :MAX :BESTLIST
END
```

BESTMATCH chooses each word according to how well it matches the template. If two or more words are an equally good match, it places them in a list and then uses GETRANDOM to select a random word.

```
TO CHANGEPOOL :WRD :BEST
  MAKE "POOL FPUT
    (UNION LAST :BEST FIRST :POOL) BUTFIRST :POOL
  IF :WRD = "VERB THEN MAKE "POOL FPUT [] BUTFIRST :POOL
  IF :WRD = "PREP THEN MAKE "POOL FPUT [] :POOL
  IF ALLOF :WRD = "NOUN (LENGTH :POOL > 1)
    THEN MAKE "POOL BUTFIRST :POOL
END
```

CHANGEPOOL updates the pool as words are used.

```
TO LENGTH :LIST
  ; OUTPUTS THE LENGTH OF THE LIST
  IF EMPTY? :LIST THEN OUTPUT 0
  OUTPUT 1 + LENGTH BUTFIRST :LIST
END
```

LENGTH monitors the length of a specified list.

```
TO GETRANDOM :LIST
  ; OUTPUTS A RANDOM ELEMENT OF A LIST
  OUTPUT ITEM (( RANDOM LENGTH :LIST) + 1) :LIST
END
```

GETRANDOM uses the RANDOM function to pick a random element from a list.

```
TO INTERSECT :SET1 :SET2
  ; OUTPUTS A LIST CONTAINING THOSE ELEMENTS
  ; WHICH ARE BOTH IN THE FIRST LIST AND THE SECOND
  IF EMPTY? :SET1 THEN OUTPUT []
  IF MEMBER? FIRST :SET1 :SET2
    THEN OUTPUT FPUT FIRST :SET1
      (INTERSECT BUTFIRST :SET1 :SET2
  OUTPUT INTERSECT BUTFIRST :SET1 :SET2
END
```

INTERSECT is used by BESTMATCH to determine whether a word is in both ALIST and the POOL.

```
TO UNION :SET1 :SET2
  ; OUTPUTS A LIST CONTAINING THOSE ELEMENTS
  ; WHICH ARE EITHER IN ONE LIST OR THE OTHER
  IF :SET 1 = [] THEN OUTPUT :SET2
  IF :SET2 = [] THEN OUTPUT :SET1
  IF MEMBER? FIRST :SET1 :SET2 )
    THEN OUTPUT (UNION BUTFIRST :SET1 :SET2)
  OUTPUT FPUT FIRST :SET1 (UNION BUTFIRST :SET1 :SET2)
END
```

UNION is used by CHANGEPOOL to determine whether a word is either the last element in the BEST list or is the first element in the POOL.

GRAMMAR SCHOOL

sists of two parts: a name, MARTIAN, and a list of its meanings words, [INTELLIGENCE MOVING HEAR SEE GROUND]. This, by the way, is an example of the kind of data structure known as an association list.

Students are now expected to devise a suitable set of meaning words, and use them sensibly with their vocabulary — which gives lots of scope for experimentation and discovery and isn't as simple as you might think. I spent ages experimenting before I ended up with anything resembling sensible sentences.

There's also lots of room to experiment with the basic algorithm. For that, you need to start thinking about how meanings are related in sentences and then trying to describe this in programming terms.

If we were to use the above algorithm, many of the words would simply get repeated over and over again. To help overcome this, two modifications to the basic strategy are incorporated in the procedures. Firstly the pool is set back to [] (the empty list) when a verb is found. That's because the words after the verb (its object) don't have to agree in meaning with those before it (the subject). Secondly, 'prepositional clauses' (things like 'WITH THE TERRIFIED ROBOT') don't need to agree too closely with the main sentence either. Here, though, we'll want to return to the main meaning pool once we've finished dealing with the prepositional clause.

To carry out our programming, set up the variable "POOL as a list of meaning pools. In data structure terms, this could best be described as a stack of association lists! Lists can be used to create very complex data structures indeed.

Looking at the procedures (see Figure 3) in more detail, ADDWORDS3 is used like this:

ADDWORDS3 "NOUN "SHIP [THING MOVING SPACE SEE]

This would add SHIP to the list of nouns, together with the given meaning words. It works in a similar way to ADDWORDS2. To run the program we type POEM3, followed by a template — just as we did for POEM2.

POEM3 initialises the pool and calls POEM3.1 which produces each element in turn, passing it to POEM3.2, until the template is exhausted. POEM3.2 controls the production of each word through BESTMATCH and CHANGEPOOL. BESTMATCH decides on which word to use and includes a refinement to cope when there are several words with the same maximum overlap with the pool; it lists them and then picks one at random. CHANGEPOOL adjusts the pool in accordance with the word chosen; use it to experiment with different algorithms for managing the pool.

If you find these procedures harder to follow than the earlier ones, don't worry because the truth is it isn't really necessary to understand them in order to use them. However, this third set of procedures does reward careful study.

Here are some of the sentences my program produced, using the same vocabulary as before, but with meaning words added:

A PARANOID MARTIAN LAUGHED IN THE DILAPIDATED DOME. A TERRIFIED MAN QUICKLY WALKED UNDER A GREEN DOME. THE MARAUDING MARTIAN QUIETLY LAUGHED AT A TERRIFIED APPARITION. A DILAPIDATED SHIP SLOWLY FLEW TOWARDS THE SPLENDID PLANET.

So... still far from perfect, but now tending to produce acceptable English more often than the previous version (there were many other sentences that made a lot less sense than these!). But the real hope is that developments like this will, as much as anything, enhance our understanding of the principles of spoken language. And of course the whole point of Logo is that it lets you get on with the job of learning, without having to worry overmuch about the finer details of programming.

ROUTINE ADVENTURES

Writing adventure programs is a difficult task. The real creativity, of course, comes in designing the map, characters and plot. But you've also got to take care of such mundane things as fitting the code and data into 37K, decoding the player's commands and keeping track of his/her location. Malcolm Serbert presents two routines to take care of the latter problems for you this month, and provides a data compression routine next month. All three can be easily incorporated into your own programs.

Y64 welcomes the submission of routines for use in adventure programs. All contributions should enclose three verified copies of the routine on tape or disk (disk preferred), a line-by-line description (see *Keyboard Kapers* for an example of the sort of thing we need), full documentation, and — if possible — a listing. Send contributions to: *Y64 Routine Adventures, 14 Rathbone Place, London W1P 1DE*. All contributions are paid for.

EVERY WHICH WAY BUT LOST

The listing below illustrates a very simple method of keeping track of a player's movements. Using this method you always know which room the player is in, whether s/he has been there before, and which exits are available.

The variable R is the current location pointer, used to read the current room number from the array A$() and the location value from the direction arrays N(), S(), E() and W() . Each time the player moves, the value of the appropriate direction array is added to the value of R (for example, if the player moves north, the value of N(R) is added to R).

The easiest way to get the hang of it is to type in the listing below and RUN it!

```
10 POKE53281,6:POKE53280,6:PRINT"■"
12 PRINT"♪ A SIMPLE DIRECTION ROUTINE"
14 PRINT" FOR ANY ADVENTURE PROGRAM."
16 PRINT" WHICH SHOWS THE PLAYER WHERE"
18 PRINT" THEY ARE NOW AND WHERE THEY"
20 PRINT" HAVE ALREADY BEEN."
22 PRINT" PRESS KEY (Y)"
26 REM**********************************
27 REM    SET UP MOVEMENT ARRAYS
28 REM**********************************
30 DIMN(9),S(9),E(9),W(9),FL(9)
35 FORX=1TO9
40 READN(X),S(X),E(X),W(X),FL(X)
45 NEXT
50 DATA3,0,2,1,0,3,0,-1,0,0,3,0,0,-2,0
55 DATA3,-3,2,1,0,3,-3,-1,0,0,3,-3,0,-2,0,0,-3,2,1,0,0,-3,
-1,0,0,0,-3,0,-2,0
60 DIMA$(9):FORX=1TO9:READA$(X):NEXT
65 DATAONE,TWO,THREE,FOUR,FIVE,SIX
70 DATASEVEN,EIGHT,NINE,TEN
75 GET A$:IFA$<>"Y"THEN75
80 R=1:REM LOCATION POINTER
85 REM**********************************
90 REM  DISPLAYING THE LOCATIONS
95 REM**********************************
100 PRINT"♪":RE$=" YOU ARE BACK AT"
110 IFFL(R)<>0THENPRINTRE$;:GOTO130
120 FL(R)=1
130 PRINT" ROOM NUMBER ";A$(R)
140 PRINT" EXITS LEAD:";
150 IFN(R)<>0THENPRINT" NORTH.";
160 IFS(R)<>0THENPRINT" SOUTH.";
170 IFE(R)<>0THENPRINT" EAST.";
180 IFW(R)<>0THENPRINT" WEST."
190 REM**********************************
200 REM  MOVING AROUND THE LOCATIONS
210 REM**********************************
220 PRINT:PRINT" WHICH WAY ? N.S.E.W."
230 INPUT Q$:Q$=LEFT$(Q$,1)
240 IFQ$="N"ANDN(R)=0THEN320
250 IFQ$="N"THENR=R+N(R):GOTO100
260 IFQ$="S"ANDS(R)=0THEN320
270 IFQ$="S"THENR=R+S(R):GOTO100
280 IFQ$="E"ANDE(R)=0THEN320
290 IFQ$="E"THENR=R+E(R):GOTO100
300 IFQ$="W"ANDW(R)=0THEN320
310 IFQ$="W"THENR=R+W(R):GOTO100
320 PRINT" SORRY! NO EXIT":GOTO190
330 REM**********************************
```


PLEASE PARSE

Parsing is the name given to the technique of turning natural language input (KILL THE INFAMOUS GRUE) into the standard <verb> <object> construct (KILL GRUE). This routine is a fairly simple but effective parser.

Full parsing routines, like the one in the Zork adventures (*Y64* issue 2), are able to act on the more complicated <verb> <object> <object> constructs (KILL THE INFAMOUS GRUE WITH THE GLOWING SWORD) and multiple commands (KILL THE INFAMOUS GRUE WITH THE GLOWING SWORD AND LAUGH QUIETLY). The listing given below does not handle double-object constructs, but it does handle multiple commands.

The module works by firstly checking for multiple commands. To do this, it looks for AND, THEN and NOW. If it finds one of these, it splits the input into two — everything before the conjunction and everything after.

Having split the input into individual commands, the next stage is to process these. It does this by searching the string for a verb and a noun which it recognises, and ignores everything else.

The routine rejects input which contains more than eight spaces (that is, a sentence with more than nine words) or more than 35 characters. The routine is slightly slower than a two-word system, but these two checks keep the delay to an acceptable level.

Lines 10-24 Set-up verb and object arrays and print to screen

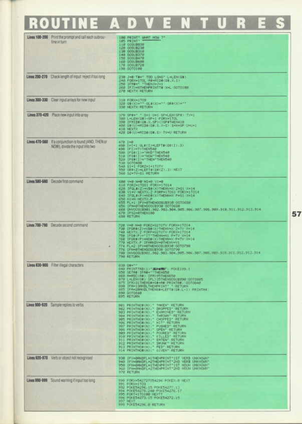
```
10 PRINT"♪■":POKE53281,6:POKE53280,6
12 DIMVB$(14),NO$(14)
14 FORX=1TO14:READVB$(X):NEXT
16 FORX=1TO14:READNO$(X):NEXT
18 DATAGET,DROP,EXAMINE,THROW,CHOP,HIT,PUSH,OPEN,POUR,KILL,EAT,DRINK,FEED,GIVE
22 DATAJUG,HAT,BOW,ICE,AXE,NET,BAG,LID,TEA,MAP,FIG,WEB,IMP,ROD
24 PRINT"     ADVENTURE GAME DECODING MODULE"
```

Lines 26-40 Condense words to first three letters

```
26 PRINT" TEST THE DECODER BY USING THESE WORDS"
28 FORX=1TO14:PRINT,VB$(X),NO$(X):NEXT
32 FORX=1TO14
34 VB$(X)=LEFT$(VB$(X),3)
36 NO$(X)=LEFT$(NO$(X),3)
38 NEXT
```

Lines 50-80 Print some examples to the screen

```
50 PRINT" EXAMPLES"
60 PRINT" ________"
70 PRINT" 1)  GET THE AXE AND CHOP THE ICE"
72 PRINT" 2)  THROW THE AXE AND THE NET"
75 PRINT" 3)  EXAMINE THE BAG NOW OPEN IT"
80 PRINT" 4)  POUR THE TEA THEN DRINK IT"
```



ROUTINE ADVENTURES

Lines 100-200 Print the prompt and call each subroutine in turn

```
100 PRINT" WHAT NOW ?"
105 PRINT"
110 GOSUB830
120 GOSUB230
130 GOSUB310
140 GOSUB370
150 GOSUB470
160 GOSUB600
170 GOSUB720
190 GOTO100
```

Lines 200-270 Check length of input: reject if too long

```
230 J=0:T$=" TOO LONG":L=LEN(Q$)
240 FORX=1TOL:M$=MID$(Q$,X,1)
250 IFM$=" "THENJ=J+1
260 IFJ>=8THENPRINTT$:X=L:GOTO100
270 NEXTX:RETURN
```

Lines 300-330 Clear input arrays for new input

```
310 FORX=1TO9
320 Q$(X)="":OL$(X)="":OR$(X)=""
330 NEXTX:RETURN
```

Lines 370-420 Place new input into array

```
370 SP$=" ":S=1:U=1:SP=LEN(SP$):TV=1
380 L=LEN(Q$)-SP+1:FORX=1TOL
390 IFMID$(Q$,X,SP)<>SP$THEN410
400 Q$(U)=MID$(Q$,S,X-S):S=X+SP:U=U+1
410 NEXTX
420 Q$(U)=MID$(Q$,S):TV=U:RETURN
```

Lines 470-560 If a conjunction is found (AND, THEN or NOW), divide the input into two

```
470 I=0
480 I=I+1:OL$(I)=LEFT$(Q$(I),3)
490 IFI>=TVTHEN540
500 IFQ$(I)="AND"THEN540
510 IFQ$(I)="NOW"THEN540
520 IFQ$(I)="THEN"THEN540
530 GOTO480
540 S1=I:FORZ=I+1TOTV
550 OR$(Z)=LEFT$(Q$(Z),3):NEXT
560 S2=TV-S1:RETURN
```

Lines 580-680 Decode first command

```
600 V=0:N=0:N1=0:V1=0
610 FORZ=1TOS1:FORX=1TO14
620 IFOL$(Z)=VB$(X)THENV=X:Z=S1:X=14
630 V1=V:NEXTX,Z:FORP=1TOS1:FORX=1TO14
640 IFOL$(P)=NO$(X)THENN=X:P=S1:X=14
650 N1=N:NEXTX,P
655 FL=1:IFV=0THENGOSUB930:GOTO680
656 IFN=0THENGOSUB930:GOTO680
660 ONVGOSUB901,902,903,904,905,906,907,908,909,910,911,912,913,914
670 IFS2=0THEN100
680 RETURN
```

Lines 700-790 Decode second command

```
720 V=0:N=0:FORZ=S2TOTV:FORX=1TO14
730 IFOR$(Z)=VB$(X)THENV=X:Z=TV:X=14
740 NEXTX,Z:FORP=S2TOTV:FORX=1TO14
750 IFQ$(P)="IT"THENN=N1:P=TV:X=14
760 IFOR$(P)=NO$(X)THENN=X:P=TV:X=14
770 NEXTX,P:IFNANDV=0THENV=V1
774 FL=2:IFV=0THENGOSUB930:GOTO790
776 IFN=0THENGOSUB930:GOTO790
780 ONVGOSUB901,902,903,904,905,906,907,908,909,910,911,912,913,914
790 RETURN
```

Lines 830-900 Filter illegal characters

```
830 Q$=""
840 PRINTTAB(1)"[illegible]";:POKE199,1
850 GETA$:IFA$=""THEN850
860 A=ASC(A$):IFA>95THEN850
870 L=LEN(Q$):IFL>35THENGOSUB990:GOTO885
875 IFA>31THENQ$=Q$+A$:PRINTA$;:GOTO840
880 IFA=13ANDLTHENPRINT" ":RETURN
885 IFA=20ANDLTHENQ$=LEFT$(Q$,L-1):PRINTA$;
890 GOTO840
895 RETURN
```

Lines 900-920 Sample replies to verbs

```
901 PRINTNO$(N);" TAKEN":RETURN
902 PRINTNO$(N);" DROPPED":RETURN
903 PRINTNO$(N);" EXAMINED":RETURN
904 PRINTNO$(N);" THROWN":RETURN
905 PRINTNO$(N);" CHOPPED":RETURN
906 PRINTNO$(N);" HIT":RETURN
907 PRINTNO$(N);" PUSHED":RETURN
908 PRINTNO$(N);" OPEN":RETURN
909 PRINTNO$(N);" POURED":RETURN
910 PRINTNO$(N);" KILLED":RETURN
911 PRINTNO$(N);" EATEN":RETURN
912 PRINTNO$(N);" DRUNK":RETURN
913 PRINTNO$(N);" FED":RETURN
914 PRINTNO$(N);" GIVEN":RETURN
```

Lines 920-970 Verb or object not recognised

```
930 IFV=0ANDFL=1THENPRINT"1ST VERB UNKNOWN"
940 IFV=0ANDFL=2THENPRINT"2ND VERB UNKNOWN"
950 IFN=0ANDFL=1THENPRINT"1ST NOUN UNKNOWN"
960 IFN=0ANDFL=2THENPRINT"2ND NOUN UNKNOWN"
970 RETURN
```

Lines 990-999 Sound warning if input too long

```
990 FORX=54272TO54296:POKEX,0:NEXT
991 FORX=1TO3
992 POKE54296,15:POKE54277,13
994 POKE54278,240:POKE54276,17
995 FORT=1TO100:NEXTT
996 POKE54273,15:POKE54272,15
997 NEXT
998 POKE54296,0:RETURN
```

SCRATCHPAD

Y64's utility workshop. Send contributions to: *Scratchpad, Y64, 14 Rathbone Place, London W1P 1DE.*

Sorting Strings

The routine below sorts an array X$() into ascending order of its first 'LS' characters. If a complete comparison is required then set LS to the length of the largest string or remove the LEFT$() and simply use the variables alone (will also speed up the sort). Bear in mind that the sort is not a true alphanumeric one, since punctuation and arithmetic symbols have lower codes than alphanumeric characters.

```
60000 REM STRING SORT —
BUBBLE
60010 FOR Y=1 TO NS—1:
FOR X=Y+1 TO NS
60020 IF
LEFT$(X$(X),LS)>=LEFT$
(X$(Y),LS) GOTO 60040
60030 X$=X$(Y): X$(Y)=X$(X):
X$(X)=X$
60040 NEXT X,Y:RETURN
```

As you were

Next time you get a '?LOAD ERROR' after patiently waiting for your 64 to LOAD in your latest 37k megagalactic hyperprogram, instead of "*X!@%%**!!!"-ing and starting again, try the following as a direct command

```
POKE 45, PEEK(831):POKE 46,
PEEK(832):CLR
```

You may then find that the program will RUN perfectly.

The explanation for this wondrous achievement lies in the error-checking performed by the 64. The reason the 64 takes so long to LOAD a program from tape is that it actually LOADs the program twice! The second time, it compares the incoming data, byte-by-byte, with the first program. If it detects a single difference, it rejects the program and gives a '?LOAD ERROR'. This is the secret to the 64's reliability at LOADing tapes.

The problem with this technique is that the error may have been in the first LOAD, while the second is actually perfectly correct. All the above POKEs do is to fool the 64 into okaying the LOAD regardless of the result of the error-checking.

Of course, if the load *was* faulty, then the program may crash, so it's not a good idea to use this technique with applications software — it's no fun entering 13k of names and addresses into your database only to have the program bomb-out when you try to save them to tape!

Disk Directories

The 1541 manual gives a program to obtain the directory without the use of the LOAD"$",8 which destroys the program currently in memory. The program in the manual is a little large to be tacked on as a subroutine so here's a shortened version. The directory listing will stop when a key is pressed and resume on the next key press.

```
60100 IF I=3 AND Y$=" " GOTO 60050
60110 IF Y$<>"" THEN PRINT Y$;:GOTO 60050
60120 PRINT:GET Y$:IF Y$<>"" THEN GOSUB 60160
60130 IF ST=0 GOTO 60020
60140 PRINT "BLOCKS FREE":CLOSE 1:GOSUB 630:RETURN
60150 REM WAIT FOR ANY KEY TO RESUME
60160 GET Y$:IF Y$="" GOTO 60160
60170 RETURN
60000 REM READ DIRECTORY SUBROUTINE
60010 PRINT"[CLS]";:OPEN 1,8,0,"$0":GET#1,Y$,Y$
60020 I=0:GET#1,Y$,Y$,Y$,X$:IF Y$<>"" THEN I=ASC(Y$)
60030 IF X$<>"" THEN I=I+ASC(X$)*256
60040 PRINTRIGHT$("[2SPC]"+STR$(I),3);" ";:I=0
60050 GET#1,Y$:IF ST GOTO 60140
60060 IF Y$=CHR$(34) THEN I=I+1:PRINT CHR$(34);:GOTO 60050
60070 IF I=0 GOTO 60050
60080 IF I=1 THEN PRINT Y$;:GOTO 60050
60090 IF I=2 THEN PRINT TAB(22);:I=I+1
```

Reordering Programs

One of the most useful programming aids is a renumbering routine. Although most people own one, most renumber routines only offer renumbering from a selected start through to the end of the program using a set increment. I thought it would be nice to take the idea a little further and allow sections to be individually renumbered. This would allow the program to be broken up into bands of line numbers for clarity and structure. This program goes one stage better and allows disk drive owners to use a text editor such as EASY SCRIPT to put their programs together piece-meal using the "load in insert mode" facility. To use this approach, the routines should be loaded in the order you want them to appear regardless of their current line numbers, and all references to them should be by the original line numbers — these will be corrected once REORDER has done its stuff.

A couple of points for EASY SCRIPT users to watch. The text should be in lower case, and beware of graphic characters that have special meanings to EASY SCRIPT.

To allow you to put together routines from which to generate the finished program, tape and disk merge subroutines are given. In order to merge programs, you need firstly to turn them into ASCII files. This is easily done.

Tape:

```
OPEN 1,1,1,"FILE": CMD1:LIST
[from — to] PRINT#1
CLOSE 1
```

Disk:

```
OPEN 1,8,1,
"FILE,S,W":CMD1:LIST
[from — to] PRINT#1
CLOSE
```

The appropriate merge routine may be used to put together as many routines as you wish by RUNning each time from 60000. The resulting program will contain the lines in the correct numerical sequence. If the programs contain overlapping line numbers, the program being read in from tape or disk will take precedence over the program in RAM. The routines below have been numbered from 60000 to keep them clear of your programs.

Tape:

```
60000 INPUT "PROGRAM"; F$
60010 POKE 19,1:OPEN 1,1,0,F$
60020 PRINT "[CLS] [3CD] POKE
153,1: POKE 198,1: POKE 631,13:
PRINT CHR$(19)"
60030 POKE 198,1: POKE 631,13:
PRINT "[HOM]":END
```

Disk:

```
60000 INPUT"PROGRAM";F$
60010 OPEN2,8,2,F$+",S,R"
60020 GET#2,B$:IF VAL(B$)<1
GOTO 60020
60030 POKE 184,2: POKE 185,2:
POKE 186,8: POKE 152,1
60040 PRINT"[CLS] [3CD]";
60050 PRINT B$;:B$=""
60060 GET#2,A$:PRINTA$;:
IF A$<>CHR$(13) GOTO 60060
60070 PRINT"GOTO 60030[HOM]"
60080 POKE 198,2: POKE 631,13:
POKE 632,13:END
```

When the program has been merged, an error message will be displayed and the process stops. Ignore this message, and delete the merge routine. The resulting program may then be saved without further work. The disk merge does sometimes miss the end of a file — should this happen, simply hit STOP.

Before an ASCII file is generated for use with REORDER, the numbering commands should be included. If none are included the start line will be 1 and the increment 1. The directive takes the form REM$NEXTLINE, INCREMENT. It must be included on a line on its own immediately before the new sequence is to start with no spaces. As many of these may be included as you wish. They will not appear in the final program and will not affect the numbering. By way of example the listing on the left has been re-ordered to that on the right: The revised program may be



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Before	After
1 REMS10,10 9 GOTO 15 10 RUN 21	10 GOTO 100 20 RUN 1001
14 REMS100,50 15 PRINT A	100 PRINT A
19 REMS1000,1 20 IF A GOTO 25 21 IF B THEN PRINT C 25 END	1000 IF A GOTO 1002 1001 IF B THEN PRINT C 1002 END

listed before saving as an ASCII file. The ASCII file must then be merged using the routines given above to produce the completed program.

To allow the program to be used for both tape and disk, all operations are carried out in memory. This limits the size of programs to 20K or so. The number of lines this represents will vary and the array dimensions should be changed to suit your style of writing. If you use short lines then use a high dimension, if you use long lines then a lower dimension is in order. The values used in the listing are entirely arbitrary and bear no relationship to the capacity of the program. Lines which *when listed* exceed 80 characters will be truncated at the end of two screen lines, so if you're in the habit of using abbreviated keywords to pack lines — watch out!

A brief description of the program and its main variables follows.

THE ARRAYS

0()	holds the original line numbers
N()	holds the new calculated numbers
ZS()	holds the line of code as it is assembled and modified
LS()	holds the keywords which can be followed by directives. A spare has been included at element 6 for anyone using an extended BASIC with another directive. More may be added as requried. Note both forms of GOTO and GO TO.
L()	holds the length of the directive keyword

Tape users need to modify line 100 to read OPEN 2,1,0,QS and line 2560 to read OPEN 3,1,1,RS.

THE PROGRAM

```
10 REM REORDER - MEMORY VERSION
20 DIM O(300),N(300),X(7),L(7),L$(7),Z$(300)
30 FOR K=1 TO 6:READ L(K),L$(K):NEXT K
40 DATA 5,GOSUB,4,GOTO,5,GO TO,4,THEN,3,RUN,3,@$*
50 PRINT:PRINT"REORDER UTILITY":INPUT"SOURCE";Q$:INPUT
"DESTINATION";R$
60 IF R$="" THEN R$=Q$
70 REM READ FILE AND ASSIGN LINE NUMBERS
```

Lines 10-70: Setting up and input.

```
100 OPEN 2,8,2,Q$+",S,R":ZN=0:IN=1:PRINT"ASSIGNING LINE
NUMBERS"
110 P$=""
120 GET#2,Z$:IF Z$=CHR$(13) GOTO 150
130 IF ST GOTO 250
140 P$=P$+Z$:GOTO 120
150 L=VAL(P$):IF L=0 GOTO 110
```

Lines 100-158: Read the sequential file building up the line into string PS. A RETURN marks the end of a line and STatus set the end of the file. Due to the way the file was generated there will be leading RETURNs and a trailing READY and another RETURN. The check on the value of L=0 will ignore them.

```
160 Z=LEN(STR$(L))+1
170 IF MID$(P$,Z,4)<>"REM$" THEN N=N+1:GOTO 230
180 Z=Z+4:ZN=VAL(MID$(P$,Z)):IF ZN<=0 THEN PRINTL;"ZERO
LINE ERROR":CLOSE2:END
190 Z=Z+LEN(STR$(ZN)):IN=VAL(MID$(P$,Z))
200 IF IN<=0 THEN PRINTL;"ZERO INC ERROR":CLOSE 2:END
210 ZN=ZN-IN:IF ZN+IN<=N(N) THEN L;"/";N(N);"DUPLICATE
LINES"
220 GOTO 110
```

Lines 170-220: These check for a renumbering directive of the form REMS and if found determine the next line number and subsequent increment. If either parameter is missing or an illegal value given then execution is ended. The directive line is not included in the final version.

```
230 O(N)=L:N(N)=ZN+IN:ZN=N(N)
240 Z$(N)=MID$(STR$(N(N)),2)+MID$(P$,LEN(STR$(L))):GOTO 110
250 CLOSE 2
```

Lines 230-250: We arrive here if the line is not a directive REMS. The old line number is logged in 0() and the new in N(). The original number is replaced by the new and the line stored in ZS().

```
500 REM ASSIGN DESTINATIONS
510 PRINT"ASSIGNING DESTINATIONS"
520 FOR I=1 TO N
```

Lines 500-620: Look for keywords to renumber.

```
530 XM=0
540 JL=0:FOR J=XM+1 TO LEN(Z$(I))
550 IF MID$(Z$(I),J,1)=CHR$(34) THEN Q=NOT(Q)
560 IF Q GOTO 610
```

Lines 550-560: If in quotes avoid renumbering words and short circuit check until closing quote found using the flag Q.

```
570 IF MID$(Z$(I),J,3)="REM" THEN J=LEN(Z$(I)):GOTO 610
```

Line 570: Nothing following a REM requires renumbering so end loop and finish with the line.

```
580 FOR K=1 TO 6
590 IF MID$(Z$(I),J,L(K))=L$(K) THEN XM=J:L=L(K):JL=K:K=6:
J=LEN(Z$(I))
600 NEXT K
610 NEXT J
620 IF JL=0 GOTO 2090
```

Line 620: If JL is set then a directive has been found so continue else do next line. XM records its position in the line.

```
630 ZD=VAL(MID$(Z$(I),XM+L))
```

Line 630: Determines the value of the original directive and puts it in ZD.

```
1000 REM CHECK EXTRA SPACES
1010 ZD$=MID$(STR$(ZD),2,1):SP=0
```

```
1020 Z$=MID$(Z$(I),XM+SP+L,1):IF Z$<>ZD$ AND Z$=" " THEN SP=
SP+1:GOTO 1020
1030 LD=LEN(STR$(ZD))+SP-1
```

Lines 1000-1040: Log in SP extra spaces between the directive and the number. To ensure when reconstructing the string later it is correct.

```
1040 IF ZD=0 AND (JL=4 OR JL=5 OR JL=6) GOTO 540
```

Line 1040: Deals with the directive words which have optional line numbers — THEN, RUN and the spare. If ZD is zero then assume no line present and go back and resume line scan.

```
1500 REM FIND DESTINATION
1510 K=1
1520 IF ZD=O(K) GOTO 1550
1530 K=K+1:IF K<N+1 GOTO 1520
1540 K=0:PRINT"BAD DESTINATION - ORIG";O(I);"NEW";N(I)
1550 Z$(I)=LEFT$(Z$(I),XM+L-1+SP)+MID$(STR$(N(K)),2)+MID$(Z$
(I),XM+L+LD)
1560 IF JL=1 OR JL=2 OR JL=7 GOTO 2000
1570 GOTO 2070
```

Lines 1500-1570: Find the new line number by equating O() and N() and replace in line. If a match is not found an error is reported and a destination of zero used.


```
2000 REM CHECK MULT DEST FOR ON ... GOTO ON ... GOSUB
2010 XX=XM+L+LEN(STR$(N(K)))-1+SP:LL=LEN(Z$(I))
2020 IF XX>LL GOTO 2070
2030 FOR J=XX TO LL:Z$=MID$(Z$(I),J,1)
2040 IF Z$=()" " AND Z$<>"," THEN J=LL
2050 IF Z$="," THEN XL=1:XM=J:L=1:JL=7:J=LL
2060 NEXT J
2070 IF XL=1 THEN XL=0:GOTO 630
2080 GOTO 540
2090 NEXT I
```

Lines 2000-2090: Checks for multiple directives. These are separated by commas so if a comma is found JL is set to 7 and the new line found by jumping back in the routine. Cycle until all lines checked.

```
2500 REM LIST AND WRITE NEW FILE
2510 INPUT"L-LIST/S-SAVE";Z$:IF Z$="S" GOTO 2550
2520 FOR I=1 TO N:PRINTZ$(I):GET Z$:IF Z$="" GOTO 2540
2530 GET Z$:IF Z$="" GOTO 2530
2540 NEXT I:GOTO 2510
2550 REM LIST AND WRITE NEW FILE
2560 OPEN 3,8,3,"@0:"+R$+",S,W"
2570 FOR I=1 TO N:PRINT#3,Z$(I);CHR$(13);:NEXT I
2580 CLOSE 3:END
```

Lines 2500-2580: List the file and save under destination name ready to be merged.

The program is not 100% foolproof and it is also very slow. The end results, though, are very pleasing. The listing given here has been run through itself and errors occurred at the DATA statement on line 40. This is because GOSUB, GOTO and GO TO all occur without a destination line. I can't think of many other areas where it might happen as variable names cannot contain reserved words.

Do remember that you can use the program to renumber routines you wish to merge to avoid conflicting line numbers.

Multicolour Mode Tutorial

Multicolour mode is something which many people find hard to grasp. Believing that the best way to teach is by example, here's a demonstration/tutorial that will tell and show you all there is to know about multicolour graphics! RUN it with the listing in front of you, and you should find it self-explanatory.

Please note that you should enter lines 150 and 160 as continuous lines, and not as shown in the listing below.

Multicolour mode is an extremely useful facility so it's strange that Commodore dismissed it in a few pages of the *Programmer's Reference Guide*. (The listing below gives references to the Guide in REM statements). This is, unfortunately, typical of Commodore — it's hardly surprising that many people don't realise how powerful the 64 is when the company itself doesn't properly document its features in the manuals!

```
100 REM MULTICOLOUR SPRITES CH.3 P.136 & P.179 TO 130
110 REM MULTICOLOUR CHAR CH.3 P.115 TO 119 AND NOTE EXTENDED
COLOUR MODE
120 REM APP.G FOR VIC CHIP MAP AND APP.N
130 REM ERROR ON P.179 FOR MULTI1 READ MULTI0 AND FOR MULTI2
READ MULTI1
140 DIM COL$(15):FOR I=0 TO 15:READ COL$(I):NEXT I
150 DATA
"[BLK]*[WHT]BLK","[WHT]*[WHT]WHT","[RED]*[WHT]RED","[CYN]*
[WHT]CYN","[PUR]*[WHT]PUR","[GRN]*[WHT]GRN","[BLU]*[WHT]BLU",
"[YEL]*[WHT]YEL"
160 DATA "[ORG]*[WHT]ORG","[BRN]*[WHT]BRN","[L
RED]*[WHT]LRD","[GR1]*[WHT]GY1","[GR2]*[WHT]GY2","[L GRN]
*[WHT]LGN","[L BLU]*[WHT]LBL","[GR3]*[WHT]GY3"
170 REM DEFINE FIXED VALUES
180 V=53248:SP=2040:BLK=11*64:REM STANDARD DATA
190 REM MULTI0/ MULTI1/ BORDER /BACKGRD 0, 1, 2 & 3
200 M0=V+37:M1=V+38:BD=V+32:B0=V+33:B1=V+34:B2=V+35:B3=V+36
:B0=6:REM BLUE BKD
210 REM SPRITE COLOURS 0, 1 & 2 AND Y CORDS
220 S0=V+39:S1=V+40:S2=V+41:Y0=V+01:Y1=V+03:Y2=V+05
230 REM MULTICOLOUR SPRITE/ MULTICOLOUR CHARACTER
240 MC=V+22:MS=V+28
250 REM SET ALL MULTI TO BLK & TURN OFF MULTI & SPRITES TO
BLK
260 POKE M0,0:POKE M1,0:POKE MS,0:POKE S0,0:POKE S1,0:POKE
S2,0
270 POKE SP,11:POKE SP+1,11:POKE SP+2,11:REM POINTERS FOR
0-2 TO BLK11
280 POKE V+16,4+2+1:REM SET X COORD MSB FOR 0-2
290 REM SET BKD'S 1-3 TO BLK
300 POKE B1,0:POKE B2,0:POKE B2,0
310 POKE Y0,50:POKE Y1,100:POKE Y2,150:REM Y CORDS
320 POKE V+21,4+2+1:REM ENABLE 0-2
330 BIT$="11111111":FORI=704 TO 704+62:POKEI,255:NEXT
340 PRINT"[CLS][4CD]";SPC(31);"SPRITE 0"
```

```
350 PRINT"[5CD]";SPC(31);"SPRITE 1"
360 PRINT"[5CD]";SPC(31);"SPRITE 2[WHT]"
370 GOSUB 590
380 GOSUB 630
390 GOSUB 590
400 PRINT"[HOM]";:IF CM AND CC>7 THEN PRINT"CHAR ARE MULTI"
410 IF CM AND CC>7 THEN PRINT"BKD 0";COL$(BB):PRINT"BKD 1"
;COL$(BC)
420 IF CM AND CC>7 THEN PRINT"BKD 2":COL$(BF):PRINT"BKD 3";
COL$(BG):GOTO 450
430 IF CM AND CC<8 THEN PRINT"CHAR ARE HIRES":PRINT"EQUAL TO
NORMAL":GOTO 450
440 PRINT"CHAR ARE NORMAL"
450 IF NOT SM THEN PRINT"SPRITES ARE NORMAL":GOTO 490
460 PRINT"SPRITES ARE MULTI"
470 PRINT"BIT PATTERN ";BIT$
480 FOR I=0 TO 3:PRINT"PAIR";I;:GOSUB 520:PRINT:NEXTI
490 PRINT"RETURN TO CONTINUE"
500 GET A$:IF A$<>CHR$(13) GOTO 500
510 GOTO 370
520 REM PAIRS AND COLOURS
530 PAIR$=MID$(BIT$,2*I+1,2):PRINTPAIR$;
540 IF PAIR$="00" THEN PRINT" BKD[4SPC]";COL$(BB)
550 IF PAIR$="01" THEN PRINT" MULTI0 ";COL$(MA)
560 IF PAIR$="10" THEN PRINT" S/COL[2SPC]";COL$(C)
570 IF PAIR$="11" THEN PRINT" MULTI1 ";COL$(MB)
580 RETURN
590 REM CLEAR TEXT WITHOUT CLEARING COLOUR
600 S$="[27SPC]":REM 31 SPC'S
610 PRINT"[HOM]";:FOR I=1 TO 24:PRINT S$:NEXT I
620 RETURN
630 PRINT"[HOM]SPRITE MENU[CD]":PRINT"1.[2SPC]BIT PATTERN"
:PRINT"2.[2SPC]SPRITE COLOUR"
640 PRINT"3.[2SPC]MULTICOLOUR 0":PRINT"4.[2SPC]MULTICOLOUR
1":PRINT"5.[2SPC]BORDER COLOUR"
650 PRINT"6.[2SPC]BACKGROUND 0":PRINT"7.[2SPC]BACKGROUND
1 CHAR"
660 PRINT"8.[2SPC]BACKGROUND 2":PRINT "9.[2SPC]BACKGRDUND
3":PRINT"10. CHAR MODE SWITCH"
670 PRINT"11. SPRITE MODE SWITCH[CD]":INPUT"SELECT[6SPC]
[6CL]";O
680 ON O GOSUB 700,740,760,780,800,820,840,860,880,900,1020
690 RETURN
700 REM BIT PATTERN
710 PRINT"8BITS[3CR]";BIT$;"[10CL]";:INPUTBIT$:BIT$=LEFT$
(BIT$+"00000000",8)
720 BYTE=0:FOR I=0 TO 7:BYTE=BYTE+VAL(MID$(BIT$,I+1,1))
*2^(7-I):NEXT I
730 FOR I=BLK11 TO BLK11+62:POKE I,BYTE:NEXT I:RETURN
740 REM COLOUR SPRITE
750 INPUT"COLOUR";C:C=CAND15:POKE S0,C:POKE S1,C:POKE S2,
C:RETURN
760 REM MULTI 0
770 INPUT"MULTI 0 COLOUR";MA:MA=MAAND7:POKE M0,MA:RETURN
780 REM MULTI 1
790 INPUT"MULTI 1 COLOUR";MB:MB=MBAND7:POKE M1,MB:RETURN
800 REM BORDER COLOUR
810 INPUT"BDR COLOUR";BA:BA=BAAND15:POKE B0,BA:RETURN
820 REM B/GROUND COLOUR
830 INPUT"BKD COLOUR";BB:BB=BBAND15:POKE B0,BB:RETURN
840 REM B/GROUND 1 COLOUR MULTI CHAR
850 INPUT"BKD COLOUR 1";BC:BC=BCAND15:POKE B1,BC:RETURN
860 REM B/GROUND 2 COLOUR MULTI CHAR
870 INPUT"BKD COLOUR 2";BF:BF=BFAND15:POKE B2,BF:RETURN
880 REM B/GROUND 3 COLOUR MULTI CHAR
890 INPUT"BKD COLOUR 3";BG:BG=BGAND15:POKE B3,BG:RETURN
900 REM TOGGLE FOR CHAR MODE MULTI OR NORMAL
910 CM=NOT CM
920 IF NOT CM THEN POKE MC,PEEK(MC)AND239:GOTO 1010
930 PRINT"0-7=HIRES":PRINT"8-15=MULTI"
940 PRINT"MULTI ANY COL>8 (BIT3 ON)"
950 PRINT"WILL HAVE BKD'S SET":REM DIFFICULT TO READ IF
MULTI AND COL>8
960 INPUT "COLOUR";CC:CC=CCAND15
970 POKE MC,PEEK(MC)OR 16
980 FOR I=1024+4*40+31 TO 1024+4*40+39:POKE 55296-1024+I,
CC:NEXT I
990 FOR I=1024+10*40+31 TO 1024+10*40+39:POKE 55296-1024+I,
CC:NEXT I
1000 FOR I=1024+16*40+31 TO 1024+16*40+39:POKE 55296-1024+I,
CC:NEXT I
1010 RETURN
1020 REM TOGGLE FOR SPRITE
1030 SM=NOT SM
1040 IF NOT SM THEN GOTO 1060:REM NOT MULTICOLOUR
1050 POKE MS,4+2+1:GOTO 1070
1060 POKE MS,0:REM NOT MULTI SO TURN OFF
1070 RETURN
1080 FOR I=1024+3*40+31 TO 1024+3*40+8:POKE 55295-1024+I,
CC:NEXT I
1090 FOR I=1024+9*40+31 TO 1024+9*40+8:POKE 55295-1024+I,
CC:NEXT I
1100 FOR I=1024+15*40+31 TO 1024+15*40+8:POKE 55295-1024+I,
CC:NEXT I
```


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KEYBOARD KAPERS

Frogger

Frogger, by Steve Patrick, is the old favourite of Atari fame. You, the frog, have to cross a busy road without getting squashed by the oncoming trucks. Use 'Z' to move left, 'X' to move right, 'F1' to move up and 'F3' for down.



SPLAT! Another frog bites the dust

```
1 REM ** FROGGER 64 BY STEVE PATRICK **
2 REM **        29 JULY 1984          **
10 GOSUB 5000
11 GOSUB 4000
20 SC=0:LI=5:TI$="000000"
21 Z=1
```

Lines 1-21 Set up variables, read in sprites, set up sound.

```
50 PRINT"■":POKE53280,0:POKE53281,0
51 FORI=55328TO56288STEP40:POKEI,6:NEXT
52 FORI=55335TO56295STEP40:POKEI,6:NEXT
53 FORI=55328TO55335:POKEI,6:NEXT
54 FORI=56288TO56295:POKEI,6:NEXT
55 POKE1056,79:POKE1063,80:POKE2016,76:POKE2023,122
56 FORI=1096TO1976STEP40:POKEI,116:NEXT
57 FORI=1103TO1983STEP40:POKEI,118:NEXT
58 FORI=1057TO1062:POKEI,119:NEXT
59 FORI=2017TO2022:POKEI,121:NEXT
60 FORI=55456TO56136STEP40:POKEI,6:NEXT
61 FORI=1184TO1864STEP40:POKEI,116:NEXT
70 REM BANKS
71 PRINT"■■
 "
72 PRINT"■
 "
73 PRINT"■   ■   ■   ■   ■   ■   ■   ■
 ■   ■   ■ "
74 PRINT"■   ■   ■   ■   ■   ■   ■   ■
 ■   ■   ■ "
75 PRINT"■■■■■■■■■■■■■■■■■■■■■■■■■■■
 "
76 PRINT"■
 "
77 PRINT"■
 "
78 PRINT"■
 ■"
```

Lines 49-78 Set up screen.

```
80 PRINT"■";TAB(153)"■POINTS■":PRINTTAB(113);SC
81 PRINTTAB(153)"■TIME■":PRINTTAB(113);RIGHT$(TI$,2)
82 PRINTTAB(153)"■LIVES■":PRINTTAB(113);LI
```

Lines 80-82 Print scores and time on screen.

```
100 FR=127:FY=235:A=137:B=190:C=131:D=165:E=101:F=140:G=101:H=115:X=201:Y=90
105 K=125:L=90:M=51:N=90
110 POKEV+14,FR:POKEV+15,FY
111 POKEV+0,A:POKEV+1,B:POKEV+2,E:POKEV+3,F:POKEV+4,X:POKEV+5,Y:POKEV+6,K
112 POKEV+7,L:POKEV+8,M:POKEV+9,N:POKEV+10,C:POKEV+11,D:POKEV+12,G:POKEV+13,H
125 IFPEEK(V+30)=<128THENGOTO150:GOTO800
```

Lines 100-125 Place frog and lorries on screen.

```
150 GETZ$:IFZ$=""THENGOTO195
151 IFZ$="Z"THENFR=FR-10:SC=SC+1:GOTO180
152 IFZ$="X"THENFR=FR+10:SC=SC+1:GOTO180
153 IFZ$="■"THENFY=FY-10:SC=SC+1:GOTO180
154 IFZ$="■"THENFY=FY+10:SC=SC+1:GOTO180
180 IFFR<20THENFR=20
185 IFFR>250THENFR=250
186 IFFY>235THENFY=235
190 POKEV+14,FR:POKEV+15,FY
191 POKE54276,17:POKE54276,16
195 PRINT"■";TAB(153)"■POINTS■":PRINTTAB(113);SC
```

Lines 150-195 Get a key and check it, then move frog.

```
200 IFPEEK(V+30)=129ORPEEK(V+30)=130ORPEEK(V+30)=132THENGOTO800
201 IFPEEK(V+30)=136ORPEEK(V+30)=144ORPEEK(V+30)=160ORPEEK(V+30)=192THENGOTO800
```

Lines 200-201 Check for collision between frog and lorries.


```
210 A=A-2:C=C+2:E=E-2:G=G+2:K=K-2:M=M-2:X=X-2
211 PRINTTAB(153)"■TIME■":PRINTTAB(113);RIGHT$(TI$,2)
212 IFTI$="000045"THENGOTO810
215 IFFY=75THENGOTO400
220 IFA=1THENA=235
221 IFC=235THENC=1
222 IFE=1THENE=235
223 IFG=235THENG=1
224 IFK=1THENK=235
225 IFM=1THENM=235
226 IFX=1THENX=235
227 IFFR=255THENFR=1
228 IFFR=1THENFR=255
230 GOTO 111
```

Lines 210-230 Move lorries and check time limit.

```
401 IFFY=75ANDFR<>47ANDFR<>97ANDFR<>147ANDFR<>197ANDFR<>237THENGOTO800
405 IFZ=1THENGOTO420
406 IFZ=2THENGOTO430
407 IFZ=3THENGOTO440
408 IFZ=4THENGOTO450
409 IFZ=5THENGOTO460
420 IFFR=47ANDZ=1THENPRINT"■■■■■■■    ■":PRINT"■■■■    ■":FR=127:FY=235
421 SC=SC+50:Z=2:TI$="000000":GOTO80
430 IFFR=97ANDZ=2THENPRINT"■■■■■■■■■■■■■■
■    ■":PRINT"■■■■■■■■■■■    ■"
431 FR=127:FY=225:SC=SC+50:Z=3:TI$="000000":GOTO80
440 IFFR=147ANDZ=3THENPRINT"■■■■■■■■■■■■■■
■■■■■■■■    ■":PRINTTAB(15)"■    ■"
```

THE GREAT SPACE




RACE
MOVI SOFT 2

```
441 FR=127:FY=235:SC=SC+50:Z=4:TI$="0000
00":GOTO80
450 IFFR=197ANDZ=4THENPRINT"";TAB(21)
"    ":PRINTTAB(21)"    "
451 FR=127:FY=235:SC=SC+50:Z=5:TI$="0000
00":GOTO80
460 IFFR=237ANDZ=5THENPRINT"";TAB(27)
"    ":PRINTTAB(27)"    "
461 FR=127:FY=235:Z=1:SC=SC+50:LI=LI+1:T
I$="000000":GOTO71
```

Lines 400-461 Check if frog home, then close base if they enter.

```
800 PRINT"SPLAT"
801 FORI=1TO1000:NEXT
802 PRINT"     "
805 LI=LI-1:TI$="000000":IFLI=0THENGOTO9
00
806 POKE198,0:GOTO80
810 PRINT"OUT OF TIME!!
"
820 FORI=1TO1000:NEXT
821 PRINT"     "
822 GOTO805
```

Lines 800-822 End of life readout.

```
900 POKEV+21,0:PRINT"":POKE53280,5:POKE
53281,0
910 PRINTTAB(14)" ROAD FROG "
915 PRINT"":PRINTTAB(10)"YOU SCORE
D ";SC" POINTS"
```

Lines 900-915 End of game readout.


```
930 PRINT"":PRINTTAB(8)"DO YOU W
ANT ANOTHER GO (Y/N)"
940 GETA$:IFA$=""THEN940
941 IFA$="N"THENEND
942 IFA$="Y"THENRUN
999 GOTO940
```

Lines 930-999 Another go?

```
3999 END
4000 REM SET UP SPRITE
4001 V=53248
4002 POKEV+21,255:POKEV+23,127:POKEV+29,
127
4003 FORS=2040TO2044:POKES,14:NEXT
4004 FORS=2045TO2046:POKES,15:NEXT
4005 POKEV+46,5:POKE2047,13
4010 FORN=0TO62:READQ:POKE832+N,Q:NEXT
4011 FORN=0TO62:READQ:POKE896+N,Q:NEXT
4012 FORN=0TO62:READQ:POKE960+N,Q:NEXT
```

Lines 3999-4012 Read in sprite data.

```
4101 DATA 0,0,0,0,0,0,0,0,0,0,0,0,3,125
4102 DATA 128,6,214,192,6,254,192,3,255
4103 DATA 128,0,254,0,7,255,192,6,254
4104 DATA 192,3,125,128,1,187,0,7,131
4105 DATA 192,0,0,0,0,0,0,0,0,0,0,0,0,0
4106 DATA 0,0,0,0,0,0,0,0
4200 REM LORRY DATA
4201 DATA 0,0,0,0,0,0,96,192,54,249,255
4202 DATA 255,249,255,255,255,255,255
4203 DATA 253,255,255,249,255,255,253
4204 DATA 255,255,255,255,255,249,255
4205 DATA 255,249,255,255,96,192,54
4206 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
4207 DATA 0,0,0,0,0,0,0,0,0
4300 REM LORRY SPRITE GOING RIGHT
4301 DATA 0,0,0,0,0,0,54,12,6,255,255
4302 DATA 31,255,255,31,255,255,255,255
4303 DATA 255,127,255,255,63,255,255
4304 DATA 127,255,255,255,255,255,31
4305 DATA 255,255,31,54,12,6
4306 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
4307 DATA 0,0,0,0,0,0,0,0,
4400 RETURN
```

Lines 4101-4400 Sprite data.

```
5001 POKE54296,15
5002 POKE54277,0:POKE54278,240
5003 POKE54273,17:POKE54272,37
5004 POKE54276,16
5010 RETURN
```

Lines 5000-5010 Set up sound.

Exocet

Exocet is a program for a 3K VIC-20. A group of enemy ships randomly make their way across the horizon, and it's up to you to sink as many of them as possible by firing missiles. A mobile sight is printed slightly below the line of the horizon. There are three sizes of enemy ships, and the smaller the target the more points you score for a hit. Occasionally the enemy's electronic defence system will succeed in confusing your missile and deflecting it from its course. Good luck!

Exucet is reprinted from *50 programs for the VIC-20* with the kind permissions of PCN/PAN Books and the author. The book is part of the PCN/PAN Computer Library.

```
10 REM***VIC 20 +3K***
20 REM*** EXOCET ***
30 REM*** CONVERTED BY DAVE PONTING ***
40 REM***C. ROBERT ERSKINE***
```

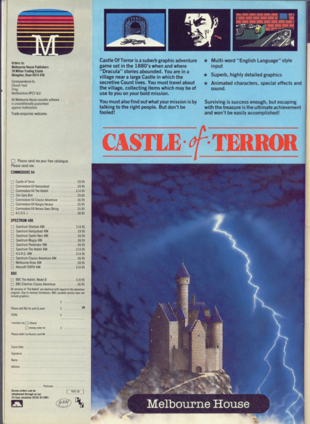
Lines 10-40 Remarks

```
80 POKE56,28:POKE52,28:POKE55,0:POKE51,0
:CLR:FORT=0TO511:POKE7168+T,PEEK(32768+T
):NEXT
85 AT$="":REM CUR
SOR/HOME + 22 CURSOR/DOWN
90 GOSUB9000:GOSUB4000:GOSUB1000:GOSUB11
70
95 POKE36878,15
```

Lines 80-95 Reset the top of Basic and initialise variables.

```
105 FORX=1TO(LEN(S$)-22)
110 IFLEN(MID$(S$,X))>21THENPRINT"
"MID$(S$,X,22)
115 PRINTLEFT$(AT$,LIN)SPC(COL)"'"
120 KY=PEEK(197):IFKY=39THENCOL=COL+(COL
>2)
130 IFKY=47THENCOL=COL-(COL<19)
134 PRINTLEFT$(AT$,LIN)SPC(COL)"<"
135 IFFLAG=1THENGOSUB2020
140 IFKY<>63ORFLAG=1THEN200
150 FLAG=1:GOSUB2000
200 IFFLAG=0THENFORXX=1TO100:NEXTXX
```


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```
202 IFEX<0THENPOKE36877,0:POKE36876,0:GO
TO3000
205 NEXTX
210 GOTO3000
```

Lines 100-210 Main game loop.

```
1000 REM SCREEN SET-UP
1005 PRINT"";:POKE36879,30
1050 COL=11:LIN=9:T=123:FLAG=0:EX=9
1100 FORX=0TO13
1120 FORY=0TO21
1130 PRINT"'";:REM SHIFTED 7
1140 NEXTY,X
1150 FORY=0TO20:PRINT"'";:NEXTY:PRINT"
'";
1152 PRINT" SCORE    EXO    HIGH"
1155 PRINT""TAB(3)SC;TAB(9)EX;TAB(15)
HS
1160 RETURN
```

Lines 1000-1160 Initial screen display.

```
1170 REM SHIP
1180 G$(1)="!       "
1190 G$(2)=CHR$(34)+"#       "
1200 G$(3)="$%&     "
1210 FORX=4TO8
1220 G$(X)="        "
1230 NEXTX
1235 Q$="                   ":S$=Q$
1240 FORX=0TO35
1250 S$=S$+G$(INT(RND(1)*8)+1)
1260 NEXTX
1270 SC=0:S$=S$+Q$:Q$=""
1280 RETURN
```

Lines 1170-1280 Set up a string of characters to form the convoy of ships.

```
2005 M$(2)="*":M$(1)=")":M$(0)="+"
2010 XX=24:YY=11:TT=16:EX=EX-1:POKE36877
,240:POKE36876,200
2020 PRINTLEFT$(AT$,XX)SPC(YY)"'";
2030 XX=XX+(LIN<XX):YY=YY+(COL<YY)-(COL>
YY)
2040 PRINTLEFT$(AT$,XX)SPC(YY)M$(SGN(COL
-YY)+1);
2050 TT=TT-1:POKE36878,INT(TT):POKE36876
,250-TT*5
2060 IF(COL<>YY)OR(LIN<>XX)THENRETURN
2065 POKE36877,0:POKE36876,0
2070 SH=PEEK(7680+22*(XX-2)+YY)
2080 IFSH<>32THEN6000
2090 GOSUB1155
2100 FLAGG=0:RETURN
```

Lines 2000-2100 Fire the rocket in the specified direction.

```
3000 POKE198,0:POKE36869,240:PRINT"
E X O C E T "
3005 PRINT" YOUR SCORE WAS"SC
3010 SC=0:EX=10:PRINT"HIT A KEY TO
 RESTART"
3020 A$="":GETA$:IFA$=""THEN3020
3030 POKE36869,255:GOSUB1000:GOSUB1170:G
OTO100
```

Lines 3000-3030 The end of the game display offers choice of new game.

```
4010 POKE36869,240
4020 PRINT"                  ____";
4030 PRINT" ┌─ ╲ ╱ ╱─╲ ╱─╲ ┌─  │ ";
4040 PRINT" ┌   X │ ││  ┌   │ ";
```

```
4050 PRINT"■└─ / \ \_/ \_/ └─  | ";
4060 PRINT"■                        "
4100 PRINT"■■■ THE OBJECT OF THIS ■  GA
ME IS TO SINK THE ■  ENEMY SHIPS WITH"
4110 PRINT"■ EXOCET MISSILES AS■  THEY
CROSS THE HORIZON"
4150 PRINT"■ HIT ANY KEY TO CONT. "
4160 A$="":GETA$:IFA$<>""THEN4160
4170 A$="":GETA$:IFA$=""THEN4170
```

Lines 4000-4170 Title display and first page of instructions.

```
4200 POKE36869,255
4210 PRINT"■■■   E X O C E T "
4230 PRINT"■■F1 =MOVE SIGHT LEFT"
4240 PRINT"■F3 =MOVE SIGHT RIGHT"
4250 PRINT"■F7 =FIRE MISSILE"
4260 PRINT"■■HIT ON $%& SCORES 10"
4270 PRINT"■HIT ON "CHR$(34)"#  SCORES 2
0"
4280 PRINT"■HIT ON !   SCORES 30"
4285 PRINT"■■■■HIT ANY KEY TO START "
4290 A$="":GETA$:IFA$<>""THEN4290
4295 A$="":GETA$:IFA$=""THEN4295
4300 RETURN
```

Lines 4200-4300 Page 2 of instructiions.

```
6005 IFSH=33THENSC=SC+30:S$=LEFT$(S$,X+C
OL-1)+" "+MID$(S$,X+COL+1)
6010 IFSH=34THENSC=SC+20:S$=LEFT$(S$,X+C
OL-1)+"  "+MID$(S$,X+COL+2)
6015 IFSH=35THENSC=SC+20:S$=LEFT$(S$,X+C
OL-2)+"  "+MID$(S$,X+COL+1)
6020 IFSH=36THENSC=SC+10:S$=LEFT$(S$,X+C
OL-1)+"   "+MID$(S$,X+COL+3)
6030 IFSH=37THENSC=SC+10:S$=LEFT$(S$,X+C
OL-2)+"   "+MID$(S$,X+COL+2)
6040 IFSH=38THENSC=SC+10:S$=LEFT$(S$,X+C
OL-3)+"   "+MID$(S$,X+COL+1)
6050 IFSC>HSTHENHS=SC
6090 GOSUB1155
6100 PRINTLEFT$(AT$,8)SPC(COL-2)"■  ,  "
6110 POKE36878,15:FORQQ=255TO120STEP-1:P
OKE36874,QQ:NEXTQQ
6500 RETURN
```

Lines 6000-6500 Hit routine. Update the score and remove the ship that has just been hit.

```
9000 RESTORE:FORT=0TO95:READN:POKE7168+3
3*8+T,N:NEXTT
9010 POKE36879,8:POKE36869,255:RETURN
```

Lines 9000-9010 Read data for the user-defined graphic characters.

```
9020 DATA0,0,0,0,0,0,16,255
9030 DATA0,0,0,0,1,39,255,127,0,0,0,0,12
8,230,255,254
9040 DATA0,0,0,0,1,255,127,63,0,24,60,63
,255,255,255,255,0,0,0,0,192,255,254,252
9050 DATA255,255,255,255,255,255,255,255
9060 DATA231,231,231,0,0,231,231,231
9070 DATA231,231,231,231,195,129,129,231
9080 DATA252,248,241,3,7,135,7,167
9090 DATA63,31,143,192,224,225,224,229
9095 DATA8,24,60,56,56,60,62,56
```

Lines 9020-9095 The data for user-defined graphics characters.

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ACROSS THE BOARDS

Below is a complete list of UK bulletin boards relevant to 64 users which were operating at the time of going to press. But they do tend to come and go, so don't be surprised if some of them prove unobtainable.

Network Knowledge

Bulletin boards are often run by hobbyists in their spare hours on a private line, so please take careful note of the operating times. It's no fun being woken at 3 am by some over-enthusiastic hacker! If the hours are listed as unknown, its best to restrict calls to reasonable times.

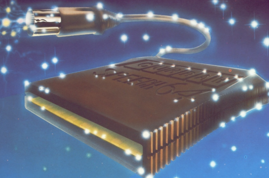
'Ring-back' means dial the number, let the phone ring once, replace the receiver and then dial again immediately. The first ring lets the modem know that you want to talk to it rather than to its owner.

Forum-80 boards are primarily aimed at TRS-80 users, but usually have some bits and pieces of general interest. Mailbox-80 boards are aimed at users of a wide variety of machines. At present, ony two boards have a Commodore SIG (Special Interest Group) — largely because the shortage of decent comms software means there are not many 64 hackers. That said, special interest groups are set up according to the demand. If you want 64 SIGs, start demanding!

Unless otherwise stated, all boards are 300/300-baud, full-duplex, 8 data-bits, no parity. Parity should not be used unless your comms software insists on it.

NAME	HOURS	TELEPHONE	NOTES
TBBS London	9 am-7 am	01-348 9400	One of the busiest and most interesting boards, hence very difficult to get through. A political talk board is one of the most interesting areas.
TBBS Southampton	24 hour	TBA	This board has been down for some time, the result of a disagreement with BT over the use of a non-approved modem. At the time of writing, it's awaiting a new (approved!) modem and phone line. Watch the other boards for details.
Mailbox-80 Liverpool	24 hour	051-428 8924	One of the original UK TBBS boards — as interesting and busy as TBBS London. XModem protocols are supported for the 64 in the download area.
Mailbox-80 West Midlands	5.30pm-8am Mon-Sat, all day Sunday	0384 635336	Newly-established, but already looking quite interesting.
The Blandford Board	24 hour	0258 54494	A TBBS board. A 64 users' SIG is being set up on this board by *Y64*; we hope that it will be at least partially operational by the time you read this. If you have any suggestions for things you'd like to see in this SIG, let us know.
CABB (Computer Answers Bulletin Board)	24 hour	01-631 3076	A TBBS system run by the magazine of the same name. The board uses an auto-select, dual-protocol modem to allow both 300/300- and 1200/75-baud rates. Recent problems with this modem have now been sorted out, so that both hard-wired and acoustic modems can access the board seven days a week. The board has a Commodore SIG; if you want access to it, just leave a message to the sysop.
CBBS London	5pm-10pm Sunday only	01-399 2136	See CBBS Cumbria (below) for notes on CBBS boards in general. CBBS London has very few messages because of its somewhat limited operating hours.
CBBS South West	24 hour	0392-53116	See CBBS Cumbria.
CBBS Surrey	Now 24 hour	04862 25174	See CBBS Cumbria
CBBS Cumbria	6pm-10pm	06992 314 Ring-back	The CBBS boards are all very similar. The messaging facilities are adequate, though not as convenient as those on TBBS boards. CBBS boards are extremely useful for hackers with large bank balances; you'll find comprehensive lists of international bulletin boards, particularly those in the States and Scandinavia. Explanations of the most important commands are given for Scandinavian boards, so you won't need to speak Swedish! At the time of writing, none of the CBBS boards have any 64 software available for downloading, but the simple cure for this is to offer to upload some of your own programs!
Forum-80 London	7pm-11pm	01-902 2546 (ring and ask for Forum-80)	Formerly known as Forum-80 Wembley. Forum-80 boards are not up to the standard of TBBS ones, but they are adequate.
Forum-80 Hull	5pm-11.30pm	0482 859169	Tuesdays & Thursdays are for registered users only. This board has a lot of US users.
Southern BB	8pm-2am	0243 511077	Runs on an Atari, believe it or not, using 'home-brew' software, but intended for users of all micros. Very few messages, and not the most convenient of boards to use, but it works.
North Birmingham BB	24 hour	0827 288810	This is now a TBBS board, and is rapidly establishing itself as one of the main UK bulletin boards.
Stoke ITeC Remote CP/M	24 hour	0782 265078	More of a novelty than a genuinely useful board at present, but has possibilities.
BABB (British Apple-user Bulletin Board)	24 hour	0742 667983	Also known by the group that runs it, the British Apple User Group. Although primarily run for the benefit of Apple-users, anyone can use the board and it does have some messages of general interest, hence its inclusion here.
TBBS Nottingham	24 hour	0602-289783	A fairly recent TBBS board run by a BT employee, no less! Not the friendliest of boards if you're unused to TBBS systems, but very neat. If you ring in the evening, your call is quite likely to be answered by the sysop, but if you ask him nicely he'll usually let you onto the board. The Hackers' Board, sadly, is no more — in deference to said sysop's employer!

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